A New Performance Sheet.

WRITTEN FOR ENGINEERING NEWS.

In the expense account of any railroad company, the item of fuel is a large one; and one which master mechanics and superintendents of motive power should always endeavor to lessen. With the constantly increasing use of coal, too, its price is certain to rise; and the only resource in attempting to keep down expenses is by better construction and management to make each pound of coal do more work. Hence it is a matter of much importance that the officers of a road know with what economy or waste their locomotives are working. To this end, much time and expense are devoted to obtaining the necessary data for the compilation of "performance sheets," a leading item of which is the consumption of fuel by the locomotives per "train mile" run.

Now it is evidently the case that a "train mile," as a unit of work done, is about as indefinite as were the old units of measure and weights that held sway in ancient times. A mile is supposed to be a reasonably constant unit of length, but a "mile" in this case—up grade, upon icy rails, or over a rough road-bed, made up of sharp curves, is a very different thing from a "mile" over a straight and level track in first-class condition. A "train" is no less indefinite, as is of course evident. It seems impossible to remedy this by the substitution of a more accurate unit for the "train mile;" for a "car mile," even if it could be practically determined, would still be inaccurate, and to use dynamometrical measurements of train resistance, as has been proposed, seems also far too complicated for practical use. Another fault, with any record based on the tractive force of the engine, is that it does not tell the whole story, for it takes no account of the steam used for working the brakes, or, in fact, of any steam that escapes at openings in the boiler other than the throttle valve.

But, although performance sheets as at present made up are evidently of little value, they would be of much service, could they be so made as to give an accurate and faithful record. From them, owners and officers of the road can learn how carefully and economically master mechanic and superintendent of motive power are performing the duties of their respective offices. Again, these officers can learn from such records, what types of engine are running most economically, what engines stand in need of repairs, and which locomotive runners and firemen are doing their work with care and economy.

Now let us see what are the principal causes of fuel waste in a locomotive. A too narrow blast nozzle will cause steam to generate faster than the engine can use it, and the surplus will flow off at the safety valve. It may also cause so strong a draft as to tear the fire when running in full gear. Defective grates, disproportioned heating and grate surface, worn or faulty valve motion, and many other defects in construction may lower the economy record; but in engines under the control of a first-class master mechanic, these defects of construction will be reduced to a minimum.

Let us next inquire, therefore, what the principal ways are in which carelessness or ignorance in running an engine may cause fuel waste. There can be little doubt that, with the exception of a proper handling of the throttle and reversing lever, the duties of the engineer have little reference to fuel economy. It is his duty to use the generated steam for whatever purpose it is required, and for the most part without reference to economy or waste. The responsibility for proper fuel economy lies with the fireman. To take proper care of a grate, burning seventy-five pounds of coal to the square foot per hour, is no holiday task, but one that requires both intelligence and industry.

The most valuable record of locomotive performance, then, is one that determines how much steam the coal makes. And it is to suggest some convenient and practical methods of obtaining such a record, that this article has been prepared.

The first method may be briefly stated as follows: Let an attendant have charge of each water tank, and let each locomotive have charged to it all coal and water taken. The keepers of each fuel station should record amounts of coal delivered to each locomotive, and be held responsible for making the whole amount of coal delivered correspond with the amount received. They should also send in weekly or monthly bills of the amounts delivered to each locomotive.

The water tanks should be provided with meters, registering preferably units of weight, and the dial reading should be taken and recorded by the keeper both before and after an engine has taken water. In addition, a locked register should be connected with the dial, by which the whole amount of water taken from the tank in a month may be known without reference to the keeper's books, and in this way his accuracy may be checked. These tank keepers should also send in periodical statements against each locomotive. If thought advisable, the engineers may also carry coal and water books, and record the amounts their engines receive. Having then the amounts of water and coal that each locomotive has received, the evaporative performance of each, and of the whole motive power may be obtained.

The water meters now on the market are adapted merely to the requirements of a city water supply. Hence it is evident that the adoption of the foregoing system would necessitate the designing of a suitable meter for the water tanks. Such a meter should have reasonable accuracy, maximum capacity, minimum space occupied, and least possible friction to cause loss of head. It must be frost proof in the coldest weather, and must not be too expensive, complicated, or liable to accident.

The designing of a meter to fill these requirements, presents, I think, no insuperable difficulties. The expense of keepers for the water stations would not be great; for, as the tanks are generally situated at stations, and the actual time occupied in tending them would be small, a switchman could have charge of them without interfering much with his other duties.

There is one objection to this system, which I am afraid would be, on some roads at least, an insurmountable obstacle in the way of its success. I refer to the ease with which the performance could be falsified by a dishonest engineer or fireman. The records are made upon the supposition that all the coal that goes into the tender reaches the furnace, and that all the water that goes into the tank is evaporated in the boiler. Hence, when "Lazy Joe" or "Fat Sam" discovers that his record is running low, or is suddenly siezed with the desire to stand at the top of the monthly list, he has only to allow the tender to leak, or dip out a lot of water, "for washing," or contrive any other method for wasting part of the water in the tank.

A little espionage might remedy this: a sharp lookout for leaks by the master mechanic's assistants when the locomotives are off duty; a tender tank from which water could not be dipped; a little watching from the conductor. But spying is a disagreeable nuisance, and I should much prefer to think that in many cases the standard of the employes is high enough so that this matter of dishonesty would not be found a great obstacle.

By the system, however, which I would next propose, this matter of wilful falsifying is remedied, and the necessity for keepers and meters at the water tanks is also obviated. It is simply to attach a meter to the feed water pipe of each locomotive. The only question concerning the practicability of this method, is whether it is possible to design a meter that will fill the existing requirements of the case. The task is a difficult one, but I think it is far from being impossible.

A meter to work in such a position, must not interfere with the working of the injector, must never under any circumstances cause a hitch in the boiler supply, must be reasonably accurate and cheap, and must, in general, be no more bother than a Sioux papoose.

Given a meter that will fill these requirements, and this system would be much better than the first named. The only way in which the record could be falsified would be by blowing off hot water from the boiler, or making a leak in the feed pipe between the meter and injector. Such cheats would hardly be attempted, because they would be easily discovered. Further, this system could be applied to engines taking water from track tanks, while the former could not. The bookkeeping required by this system is so simple as to need no explanation; and we may next consider how we shall reward diligence or punish negligence when determined by these data.

It is evident that the corporation has a right to expect from its employes a reasonable degree of care and diligence in performing their duties; therefore it is just, that, a reasonable standard of economy having been chosen, those who fall below it should have a sum deducted from their wages. On the contrary, however, those who by extra skill and diligence effect a greater economy, should have a suitable reward therefor. Neither fines nor premiums, however, should be of undue size, for fuel economy is only one of many duties that the enginemen have to perform. Of course, at the same time, a continual high record indicates a man worthy of promotion, while incorrigible laxness should furnish a subject for the bouncer.

To sum up, then, we may say that performance sheets, as they are at present made, are of little value; but that if made upon the basis of evaporative economy, as here proposed, they would be of great service in reducing the locomotive fuel consumption. Further, that the expense of this system as compared with the benefits to be derived, seem to indicate it as worthy of a practical trial.

Although I have described this system only as applied to the locomotive, there is no reason why it should not be made far more general. By simply attaching a reliable meter to their feed water pipes, and ascertaining the fuel consumption in any convenient manner, steam users of all classes may know with certainty the value of their coal, the efficiency of their boilers, the excellence or carelessness of their firemen, and the performance of their engines.

In all our varied industries, hap-hazard management and guessing are fast passing away, and in their stead are adopted the tests and methods of engineering science. By this we accelerate our progress and cause the great forces of matter and man to act in such harmony that they produce the maximum resultant.

CHARLES N. BAKER,
University of Vermont.

Characteristics of Cements, Mortars and Concretes.

The committee of the Am. Soc. C. E., below mentioned, have issued the following circular which we republish with the request that all interested readers pay heed thereto:—

The Board of Direction of the American Society of Civil Engineers having, in accordance with a resolution of the Society, appointed the undersigned as a Committee to continue the Investigation into the Characteristics of Cements, Mortars and Concretes, with especial reference to their *changes* in *dimension* under various conditions, as to their *component parts*, their *age*, and their supposed *loads*; we would earnestly invite your personal co-operation, and ask you to forward to us any information you may have upon the subject, or which you may be able to obtain by observation or experiment; remembering always that *accuracy* is absolutely essential to usefulness. Full credit will be given in the report for all contributions that may be received.

The Committee propose the following questions, to which answers are desired:

First.—What is the linear *expansion* or *contraction* of cement, neat and when mixed with one, two and three parts by weight of sand (and also of various concretes), during induration and soon after the initial set?*

Second.—What is the measured compression of the same mixtures under various loads within the elastic limit, but including also that under a destructive load, at the following ages?†

Third.—What is the measured compression, within the elastic limit, of bricks and other lithoidal building materials, and also that under a destructive load?

Fourth.—As incidental to these, and for information only (to be placed in an appendix), what actual compressive strengths have been attained from the mixtures named, and at the several ages under head *Second*?

Fifth.—As another outside inquiry, can you give personal or other well-authenticated experience as to the laying of masonry successfully in frosty weather, and the methods pursued?

The Committee would offer the following suggestions as to how observations and tests should be made and the precautions that should be observed.

First.—Measurements may be made over carefully fixed points on masonry in progress, at successive periods of time up to completion; noting thickness and number of joints, loading, character of work, kind of mortar, etc., and temperature at time of measuring. Temperatures should be noted in all experiments in which a change might introduce error into the results obtained.

Second.—Experimental columns may be built, and a series of measurements taken, under the varying conditions heretofore specified.

Third.—Prisms may be made of cylindrical or square section (preferably the former) and of dimension within the capacity of the testing machine at hand, and carefully tested. To insure freedom from lateral flexure, the diameter should be to the length as about 1 to 6, and for uniformity's sake this ratio is recommended.

For the load under a destructive test, cubes having 2-inch sides, to be made of the same mixtures, at the same time, and tested at the same ages. One-inch cubes may be used if the 2 inch are beyond the capacity of the machine, but the fact should be stated.

The readings for compression should be taken by some form of vernier, or multiplying lever, and it is desirable that they should be read to the ten-thousandth of an inch.

In measuring compressions, the attachments of the measuring apparatus should be *entirely to the* specimen, and not to the machine, so as to eliminate all errors from lost motion, etc.

The fineness of the cement used should be stated, if practicable—as found by testing a portion with a No. 100 sieve (10,000 meshes to the inch) and also to the brand.

Enough preliminary tests should be made with mortars prepared by admixture of the "standard sand" recommended by the Committee on Tensile Tests, to establish a basis of comparison with the *local* sands which may be then used.

*In making these observations, the action of induration should be closely observed, to determine whether there may not be a *preliminary* expansion and subsequent contraction, or the reverse.

(*a.*) When subject to no extraneous pressure.
(*b.*) When subjected to different pressures.
(*c.*) How affected by the amount of water used, including an examination of grouts.

†It is desirable that briquettes for tensile tests be made from the same mixtures and tested at corresponding times for purposes of comparison.

(*a.*) After one day.
(*b.*) " one week.
(*c.*) " one month.
(*d.*) " six months.
(*e.*) " one year, etc.

The proportions of cement, sand, and water should be determined by weight; enough of the latter being used to make a "stiff, *plastic* paste, the cement and sand being dry, and the water added all at once."

The moulds should be filled from the end, rammed lightly with a wooden stick of 1-inch diameter, at about each three inches of height; submitted for a few seconds to a weight on the upper surface equal to five pounds to the square inch of section, and then smoothed off with a trowel.

The test pieces should not be immersed in water, unless it be found by experiment that the accuracy of the tests shall be vitiated by the development of cracks.

Great care should be taken to insure accurate contact between the end surfaces of the test pieces and the plates of the machine, thin strips of soft wood, about ¼-inch thick, being recommended for this purpose.

In the use of wood for this purpose, it is found to introduce error, however, by causing *premature splitting* in the direction of the grain of the wood, *except the following precautions be taken*, viz., to use a socket of say ⅛-inch depth, with a diameter of say ⅛-inch more than that of the test piece. This not only confines the wood and prevents the splitting action, but serves as a ready means of accurately centering the test piece in the machine.

Experience may indicate changes in the suggestions here made, in which case a supplementary circular will be issued.

It is particularly requested that all details of experiments be fully given, including the kind of machine used and everything bearing on the accuracy of results.

Please address replies or communications to F. Collingwood, Chairman, care American Society Civil Engineers, 127 East Twenty-third street, New York.

F. Collingwood,
D. J. Whittemore,
Thomas Lincoln Casey,
A. V. Abbott,
George F. Swain,
Committee.

Report of the European Geodetic Association.

The third appendix of the report on the Seventh General Conference of the European Geodetic Association contains an interesting account of the base-lines measured during the period from 1881 to 1883 and the apparatus used in the work. Six base-lines were measured during that time, one in Austria, one in the United States of North America, two in Norway, and two in Switzerland. The Austrian base-line was measured by the Imperial Military and Geographical Institute, with the Austrian standard apparatus; it is located between Ilidze and Sarajewo. The measuring rods are of iron, and were used simultaneously; they are cut exactly to standard measure. The base is 4,061 metres (13,320 ft.) long, was divided into five sections and measured twice. Proportional error, $\frac{1}{3,700,000}$.

The American base-line (in Yolo County, California) has the unusual length of 17,486 metres (57,370 ft.) and was measured with the improved apparatus of Scholl; the rods are 5 metres (16.4 feet) long and are made of two steel rods, with a rod of zinc between them. The different rods are so dimensioned and arranged, that the expansion of the zinc is compensated by that of the steel. This base was measured twice in seventeen divisions. Proportional error, $\frac{1}{1,700,000}$.

The Norwegian base-lines of Joederen and Bodoe were measured with the Norwegian standard apparatus, a modification of Struve's apparatus, advised by Baron Wrede. The four rods (of one metal only) are made of gas pipes usually cut to measure; the temperature is ascertained by quicksilver thermometer; the spaces between the rods are measured by levers. The entire measurement has been made only once at present.

The Swiss base-lines of Weinfelden and Bellinzona have been measured twice with the improved apparatus of Ibanez mentioned some time ago in Engineering News.

The precaution, proposed by M. Fisher, was used here, that each section (Weinfelden base, 2,549 metres (8,333.5 ft.) long, divided in six, and Bellinzona base, 3,200 metres (10,409 ft.) long, divided in eight sections) was measured once in the forenoon, when the temperature was increasing, and once in the afternoon when the temperature was decreasing, so that the average was free of the influence of the temperature. Proportional errors, Weinfelden $\frac{1}{3,500,000}$

Bellinzona, $\frac{1}{9,000,000}$.

The Influence of Changes of the Atmospheric Pressure upon Fire-Damps.

The great disasters in the spring of 1885, caused by fire-damps in a number of coal mines, moved the General Manager, Rudolf von Walcher-Uysdal, to make extensive investigations of the question of fire-damps, with special reference to the effect of changes of temperature. This question has been discussed frequently, but never so carefully investigated as in the Grabriel coal mine at Karwice (Hungary), where a complete meteorological station was established. The report, issued by Mr. Walcher-Uysdal, is very complete and exhaustive. The limited space at our disposal does not allow us to mention more than the principal facts and conclusions.

The observations made at the time of different catastrophes are:

1. Polnish Ostrau, October 8, 1884. During three days barometer very high; catastrophe occurs during the falling of the barometer (11 millimetres in 48 hours).

2. Karwice, March 6, 1885. During five day barometer very high with small changes; two days after the barometer commenced to fall (16 millimetres in 3 days) the explosion occurred. An exceedingly strong current of gas was observed during the same period in the workings of the Grabriel shaft at Karwice, which is connected with the Johann shaft, where the explosion occurred.

3. Saarbruecken (Germany), March 18, 1885. During seven days very high, somewhat oscillating barometer; the explosion occurred on the second day of the rapid fall of the baroterm (1 3 millimetres).

4. Clifton Hall, June 18, 1885. During eight days very high atmospheric pressure, decreasing very slowly; when the barometer fell, an explosion occurred. The conclusions arrived at in the report, are as follows:

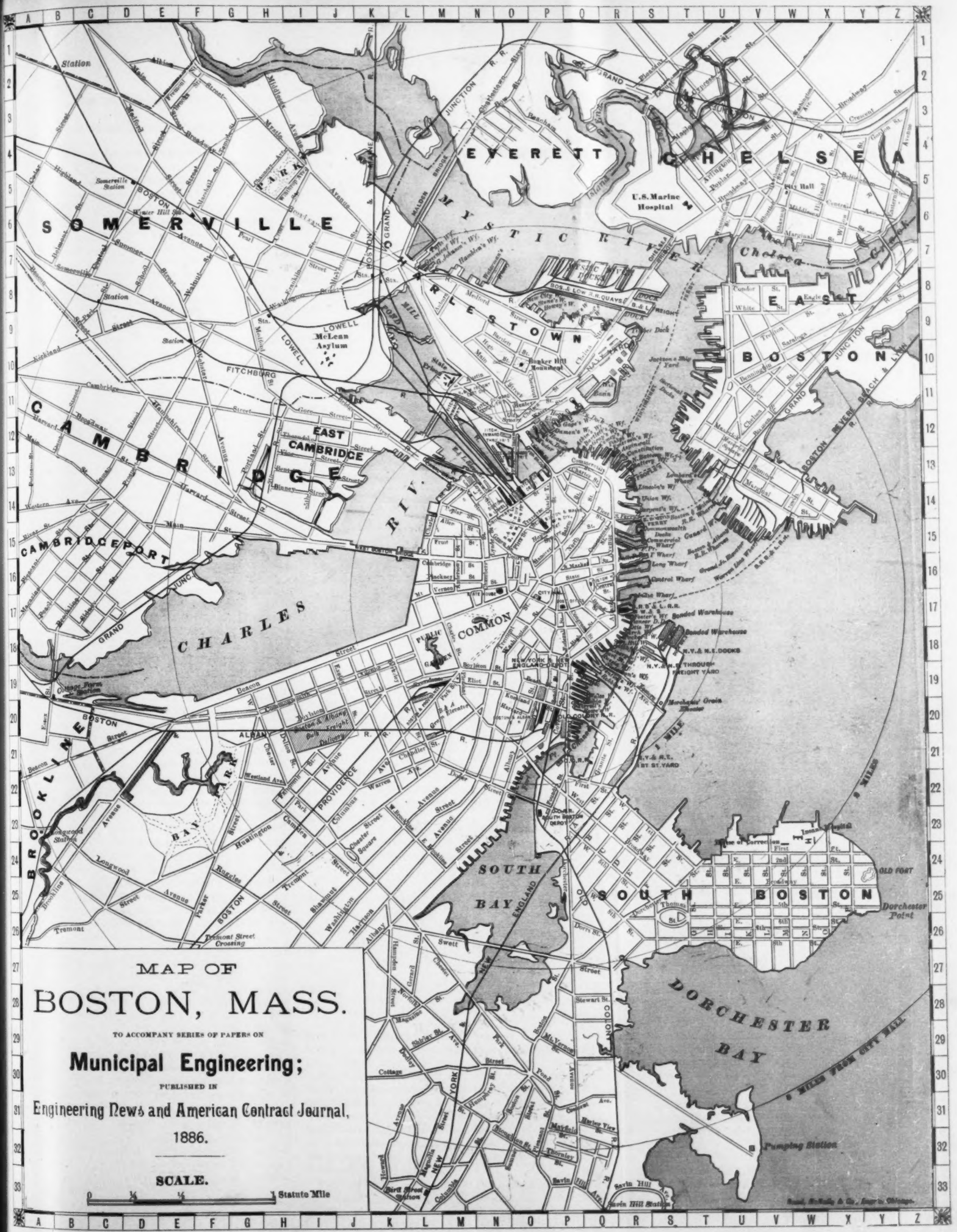
1. The amount of gas contained in the underground air generally decreases with the increasing and increases with the decreasing atmospheric pressure.

2. The amount of gas increases the more rapidly, the more sudden the atmospheric pressure decreases, and decreases the quicker the more sudden the barometer rises.

3. The development of the fire-damp does not depend upon the absolute atmospheric pressure.

4. If the sudden raise of the barometer is followed by a slower raise, or if it remains constant for some time, the amount of gas increases gradually. If the rapid fall of the barometer is followed by a slower fall, or if it remains at the same height, after having reached the minimum, the amount of gas slowly decreases. Therefore the maximum, respectively the minimum of the barometer, does not always correspond to the minimum, respectively the maximum amount of gas.

The report of Mr. Walcher-Uysdal can be highly recommended to the owners and managers of coalmines, as it is a step in the right direction, to solve this important question.—*Wochenschrift des Oesterreichischen, Ingenieur- und Architecten-Vereins.* October 17, 1886.


SOMERVILLE
EVERETT
CHELSEA
MYSTIC RIVER
CHARLESTOWN
BOSTON
CAMBRIDGE
EAST CAMBRIDGE
CAMBRIDGEPORT
CHARLES RIVER
BROOKLINE
BOSTON
BAY
COMMON
PUBLIC GARDENS
SOUTH BAY
SOUTH BOSTON
DORCHESTER BAY
FORT HILL
U.S. Marine Hospital
LOWELL McLean Asylum
Bunker Hill Monument
Pumping Station
Old Fort
Dorchester Point
Tremont Street Crossing
Kneeland Street Crossing
Beacon Street
Boylston Street
Washington Street
Commercial Street
Atlantic Avenue
Summer Street
Broadway
Dorchester Street
Old Colony R.R.
Boston & Albany R.R.
Fitchburg R.R.
Eastern R.R.
Boston & Lowell R.R.
Boston & Maine R.R.
New York & New England R.R.
Providence R.R.
Old Colony & Newport R.R.
Boston & Albany Freight Delivery
Boston & Albany Grain Elevator
Boston & Albany Coal Wharf
Boston & Albany Freight Yard
Boston & Albany Engine House
Boston & Albany Car Shops
Boston & Albany Freight Station
Boston & Albany Passenger Station
Boston & Albany Engine Shops
Boston & Albany Coal Pockets

Municipal Engineering; Paper No. 1.*

BOSTON, MASSACHUSETTS.

(*Continued from page 69.*)

Boston Water Supply.

The first recorded attempt of any kind towards a public water supply for Boston dates back to March 1652, when a "water-conduite was set up" for extinguishing fires and for domestic use. This original plant included a reservoir 12 feet square, located near the present Dock Square, and into which water was led by wooden pipes from neighboring springs. Nothing further seems to have been done in this direction until June 10, 1796, when The Aqueduct Company was incorporated, with a capital of $130,000, to bring water into the town by subterranean pipes from Jamaica pond, in Roxbury. There were four mains of pitch-pine logs, two of 4-inch and two of 3-inch bore; the distribution pipes were also of wood with 1¼-inch bore.

The first public supply of any real importance was introduced on October 25, 1848, when, after some years of labor, water was led into the city from Lake Cochituate. This supply becoming inadequate to meet the demands of the rapid growth of the city, the Massachusetts Legislature, in April, 1872, passed an Act authorizing the city to take an additional supply from the Sudbury river; and about 1878 the new works were put into operation. By the annexation of Charlestown in 1874, the City of Boston came into possession of the Mystic Water Works.

The various sources of supply and reservoirs may be described in somewhat further detail, as follows:—Lake Cochituate is about twenty miles west of Boston and has a water-surface of 800 acres, a total capacity of 2,011 millions of gallons and an elevation of 134.36 feet above "tide-marsh level" at high water mark. Connected with the lake supply are Dug pond, with 44½ acres and an elevation of 141.36 feet, and Dudley pond covering 81 acres and with an elevation of 146.46 feet. The water is led from Lake Cochituate by a conduit 14½ miles long, and generally 6 feet 4 inches high by 5 feet wide, to the Chestnut Hill reservoir, about 5 miles from the City Hall. This reservoir has a capacity of 730,000,000 gallons and an elevation of water surface of 124 feet. Chestnut Hill reservoir is connected by a conduit with the Brookline reservoir, about one mile distance, and having a capacity of nearly 120,000,000 gallons and an elevation of water surface of 124 feet. A high-service reservoir is situated upon Parker's Hill, about 3 miles from Boston and 219 feet above marsh-level; it contains 7,200,000 gallons and is filled from a pumping station in the Roxbury district, having a lift of 108.5 feet.

The Sudbury River supply is stored by three dams impounding nearly 2,000 million gallons of water, the flash-board elevation of the upper dam being 175.24 and of the lower dam 159.29 feet; a fourth basin is under construction. The daily average flow of the river is 75,000,000 gallons. A brick conduit conveys the water from the lower dam to Farm pond in Framingham, a distance of 4,170 feet; and from there another conduit, with a daily capacity of 80,000,000 gallons, carries the water to the Chestnut Hill reservoir—a distance of about 16 miles.

The Mystic Lake, the source of the Mystic water supply, is situated in the "towns" of Medford, Arlington and Winchester, and is 6¼ miles from Charlestown square. Its storage capacity at high water is 380,000,000 gallons, with a drainage area of 27¾ square miles and an elevation of surface of only about 7 feet above tide-level. The water is pumped to a reservoir, holding 26,244,000 gallons, on Walnut Hill in Medford with its high water mark 147 feet above mean high tide. Besides supplying the Charlestown district, this reservoir furnishes water to the towns of Somerville, Chelsea and Everett. The water-shed of the Mystic supply is now being so rapidly settled that it is doubted if even the most elaborate sewerage system can save it from contamination. It will be probably abandoned in the early future, and a supply taken from the Shawshine River about 3 or 4 miles further away from Charlestown, but across the divide and in a rocky, thinly settled district.

A new high-service reservoir is now under construction on Fisher's Hill in Brookline, and is expected to be completed within two years.

The cost of construction of the Cochituate system of water works, to May 1, 1885, is put down by the City Auditor at $18,173,644.45. The cost of construction of the Mystic water works, to the same date, is given as $1,656,226.50.

The income from water rates, fees, etc., for the year ending June 30, 1885, was, from the Cochituate, $1,220,337.89; from the Mystic works for the same period a total of $273,784.84 was received.

The cost of maintenance of the Cochituate works was, for 1884-85, $336,578.86, and for extension, $115,013.02; the interest account was $668,658.07. For the Mystic works, the maintenance, for 1884-85, cost $128,126.40, and extension, $449.03; the interest paid was $48,960.

For the Sudbury and Cochituate works, the daily average consumption in 1884-1885 was 25,090,500 gallons, or 68 gallons per head per diem. The daily average amount used through meters was 5,171,120 gallons, or 20.3 per cent. of total consumption. The total number of services equalled 50,632, and there were in use 4,666 meters and motors.

For the Mystic works, the daily consumption in the same period was 6,209,700 gallons, or 71 gallons per head per diem. The percentage of metered water was 14, and the number of services 14,939, and of meters and motors, 571. The cost of pumping one million gallons one foot high was $0.067.

Water Distribution.

Standard Pipe Dimensions.—The pipe used by the Boston Water Board is of cast-iron "of such a character as to make a pipe strong, tough, and of even grain, that will satisfactorily admit of drilling and cutting, and shall possess a tensile strength of at least 16,000 pounds per square inch."

All pipes are coated with coal-pitch varnish applied according to Dr. Angus Smith's process. Both the pipe, before immersion, and the bath are heated to 300° Fahrenheit and the casting is allowed to remain immersed 30 minutes. All pipes are tested at the foundry by water pressure to 300 pounds per square inch.

The following table gives the weights and dimensions of cast-iron water pipe as adopted in the Boston works, reference being had to Plate 4:

In the following "bell and spigot" diagram

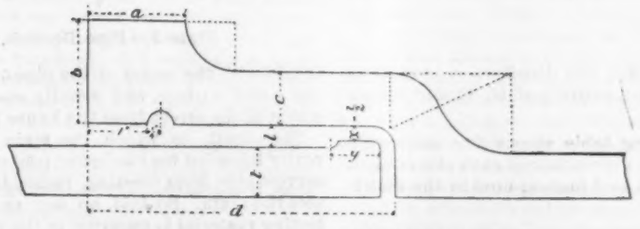
$$v \begin{cases} \text{For 4-in., 6-in. and 8-in. pipes} = 0.6 \text{ inch.} \\ \text{" 10-in. and 12-in.} = 0.8 \text{ "} \\ \text{" larger pipes} = 0.85 \text{ "} \end{cases}$$

The weight of iron is taken at .2064 pounds per cubic inch.

Weights and Dimensions of Cast-Iron Water Pipes, Boston Water Works.

Diameter.	Class.	Dimensions in Inches.						Total Length.		Total Weight of Pipes.	Weight per Running foot laid.
Inches.		a	b	c	d	t	l	ft.	in.	lbs.	lbs.
4	B	1.50	1.30	0.65	4.0	0.45	0.40	12	4	260	21.7
6	B	1.50	1.40	0.70	4.0	0.50	0.40	12	4	418	34.8
8	B	1.50	1.50	0.75	4.0	0.55	0.40	12	4	601	50.1
10	B	1.50	1.60	0.80	4.5	0.60	0.40	12	4½	815	67.9
12	A	1.50	1.60	0.80	4.5	0.58	0.40	12	4½	935	77.5
12	B	1.50	1.70	0.85	4.5	0.65	0.40	12	4½	1050	87.5
16	A	1.75	1.70	0.85	5.0	0.66	0.50	12	5	1413	117.7
16	B	1.75	1.90	0.95	5 0	0.75	0.50	12	5	1615	134.6
20	A	1.75	1.90	0.95	5.0	0.73	0.50	12	5	1945	162.1
20	B	1.75	1.90	0.95	5.0	0.85	0.50	12	5	2252	187.7
24	A	2.00	2.10	1.05	5.0	0.81	0.50	12	5	2588	215.7
24	B	2.00	2.10	1.05	5.0	0.94	0.50	12	5	2985	248.8
30	A	2.00	2.30	1 15	5.0	0.93	0.50	12	5	3690	307.5
30	B	2.00	2.30	1.15	5.0	1.10	0.50	12	5	4336	361.3
36	A	2.00	2.50	1.25	5.0	1.04	0.50	12	5	4929	410.7
36	B	2.00	2.50	1.25	5.0	1.25	0.50	12	5	5832	490.2
40	A	2.00	2.70	1.35	5.0	1.12	0.50	12	5	5897	491.4
40	B	2.00	2.70	1.35	5.0	1.35	0.50	12	5	7055	587.9
48	.....	2.00	2.70	1.35	4.0	1.00	0.50	12	4	6266	522.1
48	.....	2.00	3.00	1.50	5.5	1.25	0.50	12	5½	7917	659.7
60	.....	2.25	3.10	1.70	6.0	1.375	0.50	12	6	10959	913.2

In the above table two classes, A and B, are considered; class A, the lighter pipes, is generally used where there is the least head; while class B is put into the lowest levels of high service districts. Special castings are always made under the requirements of class B.



Pla te 4.—Standard "Bell and Spigot" Diagram.

The formula used in the calculations for the thickness of pipes laid in the Boston distribution system is one arranged and adopted by Joseph P. Davis, C. E., while City Engineer. It is as follows:

$$t = 0.0048\, n\, d + 0.35$$

where t = thickness of pipe; d = diameter of pipe in inches, and n = head in feet divided by 33.

General Plans of Distribution. Dexter Brackett, C. E., the engineer-in-charge of the Boston distribution system, and one who has for a long time made this work his especial study, has kindly furnished us with the fol-

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lowing notes on this subject along with other valuable assistance:—The general plan of distribution now adopted is to have 12-inch mains at intervals of from 1,000 to 1,500 feet, with 8-inch and 6-inch mains on the intermediate streets. In the business portions of the city the 12-inch mains are more frequent still; and in the part of the city, destroyed in the great fire of 1872, the distribution system is made up almost entirely of 16, 12 and 8-inch mains.

The following table shows the aggregate length and the percentage of each size of pipe, from 16-inches to 4-inches, now in the distribution:—

Diameter.	Length in Miles.	Per Cent.
16-inch.	9.4	3.
12 "	104.6	30.7
10 "	3.1	1.
8 "	34.3	10.
6 "	162.0	47.5
4 "	26.6	7.8
	340.0 Miles.	100.0

Since 1872 no main smaller than 6-inches has been laid except in short and narrow courts.

As showing the advantage that Boston now has in its distribution system, Mr. Brackett has made the following comparative table based on the proportion of pipe in the distribution systems of the respective cities named, which is under 6-inches in diameter:—

Philadelphia has	30	per cent.	of pipe	less than	6-inches.
Cincinnati "	58	"	"	"	"
Chicago "	30	"	"	"	"
Louisville "	49	"	"	"	"
Baltimore "	70	"	"	"	"
Boston "	7⅛	"	"	"	"

Laying Water Pipe. In Boston, water pipe is laid with the center of the pipe 5 feet below the street surface, and usually one-third the width of the street from the house line.

The depth to which the main is laid is really intended for the better protection of the service pipe from freezing, rather than to protect the main. So laid, no hay or other protecting material is required in the valve-boxes at the bottoms of the hydrants, etc.

The present cost, per lineal foot of laying by day's labor 4, 6, 8, 12 and 16-inch pipe is tabulated by Mr. Brackett as follows:

Class of material, or work.	Diameter in Inches.				
	4	6	8	12	16
Pipe and special castings	$0.38	$0.57	$0.83	$1.27	$1.87
Lead, gasket, blocking, etc.	0.05	0.06	0.08	0.12	0.17
Teaming	0.02	0.03	0.05	0.07	0.08
Labor	0.25	0.27	0.30	0.37	0.45
Total cost	$0.70	$0.93	$1.26	$1.83	$2.5

In the above table the pipe is figured at 1¼ cents per pound, and the labor at $2.00 per day. The cost of gates, hydrants, etc., of the above sizes, would be about 15 cents per pound.

The lead used per joint in pipe laying is figured by the Boston department according to the following rule:

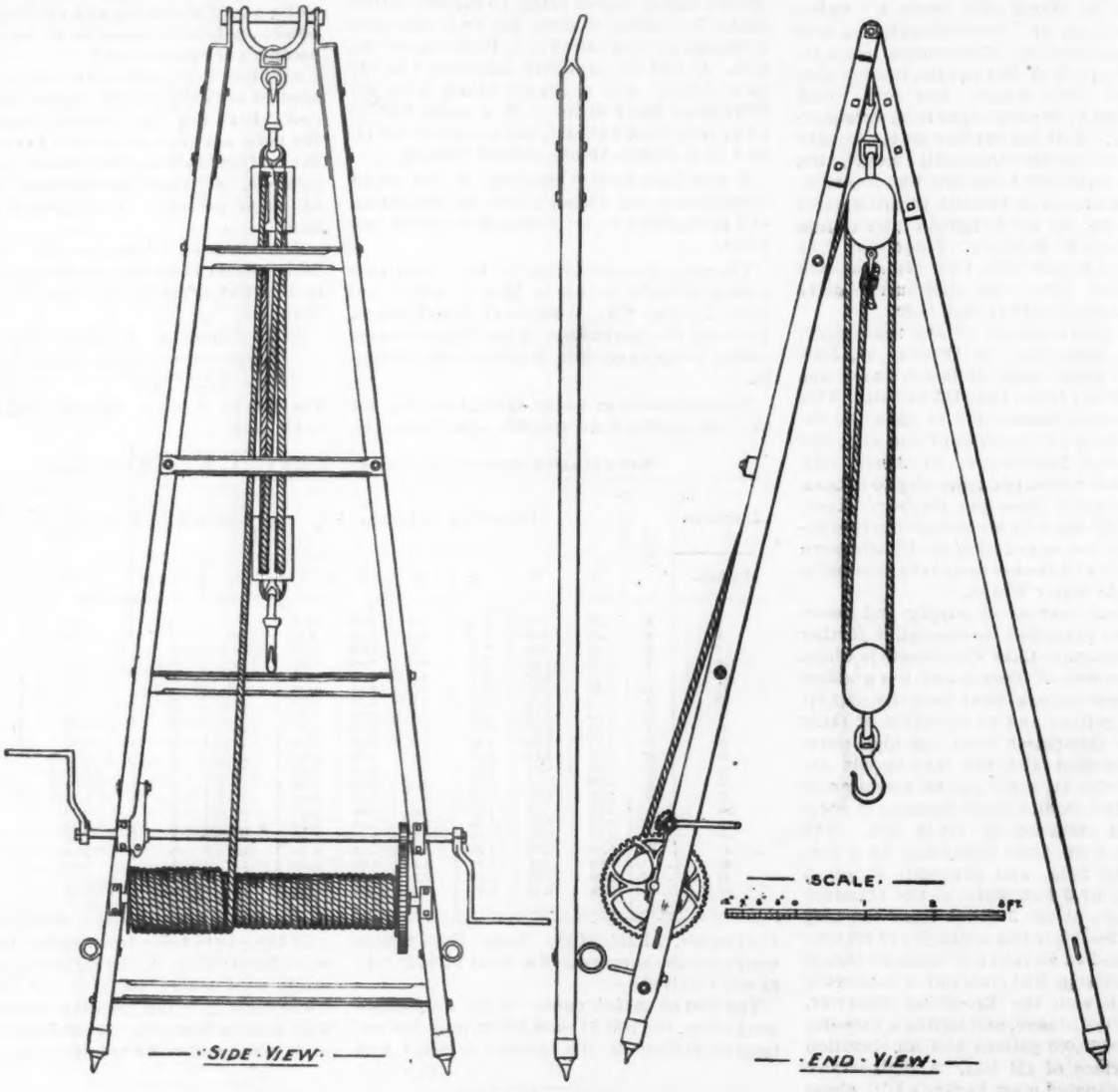


Plate 5.—Pipe Derrick.

Pounds of lead per joint = { Diameter of pipe in inches multiplied by 2.

This rule, simple as it appears, is found, even in large pipes, to come very close to actual amounts used in practice; it allows for the inevitable waste in pouring, etc., and the setting of gates, branches, etc. In pouring lead joints, the Lead Jointer, invented by Thomas Watkins of Johnstown, Pa., is now very generally used. Superintendent Jones testifies to its merits and economy in the use of lead; but he has a method of his own in adjusting the canvas-and-rubber band so as to make the layers stand vertical to the outside of the pipe, instead of being concentric with the pipe circumference according to the usual method. The plan followed by Mr. Jones, while a little more troublesome in the handling of the rubber, prevents the peeling off of the bottom layer from heat and makes the band last longer.

The Pipe Derrick shown in Plate 5 is a very common device; but were one to be built we

fear our readers would have some trouble in finding a plan, and hence we have illustrated it. Derricks of this description are useful in laying pipes of 12-inches and over in diameter: the plan requires little description.

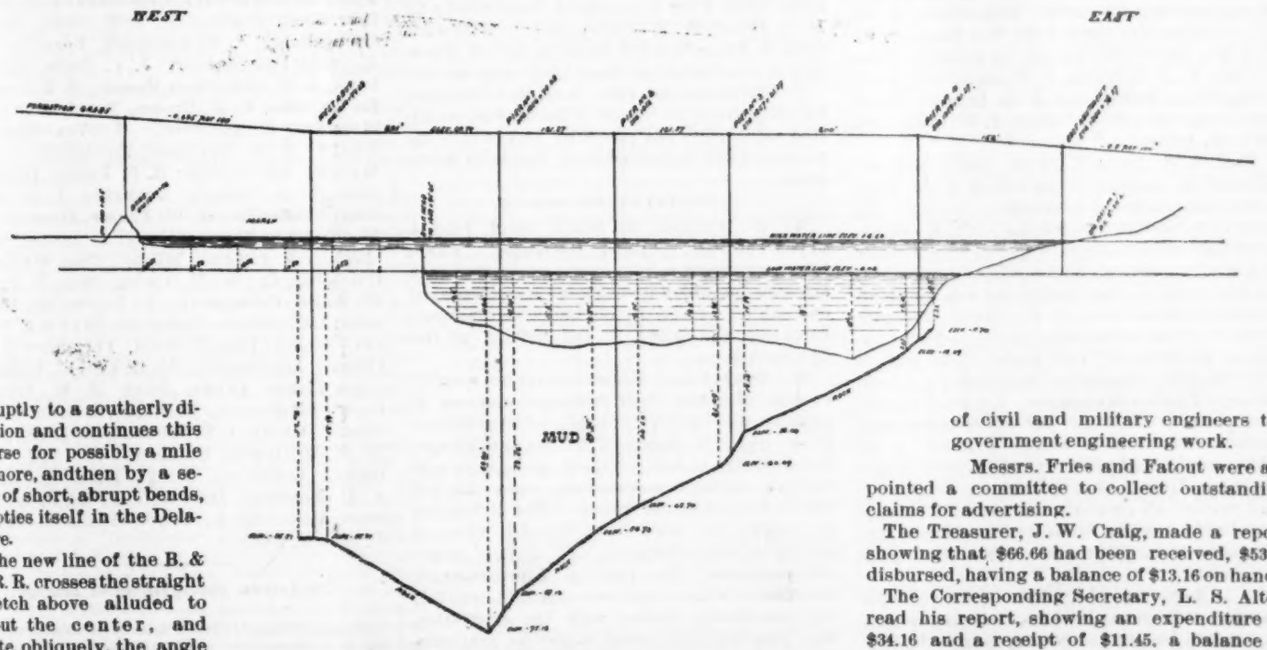
TO BE CONTINUED.

The Schuylkill River Bridge of the B. & O Railroad.

Written for ENGINEERING NEWS.

BY COL. WM. M. PATTON, ENGINEER IN CHARGE.

The Schuylkill river, in its passage through the city of Philadelphia follows a very tortuous channel, with no very great width; just above Gray's Ferry its course is to the westward, and but a short distance above the old P. W. & B. bridge it changes its course abruptly to a southerly direction and continues this course for possibly a mile or more, and then by a series of short, abrupt bends, empties itself in the Delaware.



The Schuykill River Crossing of the B. & O. Railroad.

The new line of the B. & O. R. R. crosses the straight stretch above alluded to about the center, and quite obliquely, the angle of skew being 53° 15' and curving to the left on the east bank it follows closely the line of the Schuylkill for some distance.

The accompanying profile shows the number, length and arrangements of spans, number of piers, height above water, depth of water, depth of mud, etc. There are two abutments and (4) four piers with length of spans as follows: one span 201 feet; one span 121.37 eet; one span 121.37 feet (these constituting the draw span); one span 200 feet; one span 152 feet long. The west abutment is located on a marsh, which is only covered with water at high tide, and is intended to support the thrust of the embankment on the west side of the river. The preliminary borings showed such great depths to the rock, that it was determined upon to sink five (5) pneumatic caisson foundations. Subsequent and more extended borings around the site of the piers, resulted in the substituting an open cofferdam for the pier nearest the east shore.

The depth of water at low tide averages about 14 feet, the depth of mud and gravel varies from 3 feet to 64 feet. The borings showed very considerable inequalities of the surface of the rock, and indicated that blasting to a great extent would ultimately be necessary.

In all essential points the same construction of caissons was adopted as was used in the foundations of the Susquehanna River bridge, some modification of form and details was rendered necessary, as we had to sink a caisson to carry a pivot or circular pier and an abutment to carry the thrust of an embankment; description and details of these will be given in subsequent articles, as will also an account of the nature, difficulties and progress of the work.

It will be noted that the grades on the west side of the river falls rapidly to the bridge proper, while on the east side it ascends towards the bridge. Whatever may be said as to the advantages of approaching a bridge by ascending or descending grades from both directions, the final settlement of this question is determined by the necessities of the case. The alignment and grades necessary to be established in approaching and passing through a large city cannot be based on any considerations of economy of construction or of subsequent operation of the road, but are fixed by roads, streets, structures etc., which must be crossed above, at grade, or below, or by structures which cannot be moved, and each in its turn controlling to a greater or less extent the manner of crossing or passing the fixed points on either side. These and similar considerations are in general sufficient to explain the steep grades, broken grades and sharp curves frequently followed in the location and construtions of railways through large cities. Few rivers as small as the Schuylkill are navigated by vessels of as large tonnage and in such numbers, or that present as many difficult engineering problems and difficulties as is experienced in the construction of a bridge over its surface.

(TO BE CONTINUED.)

Indiana Surveyors.

The sixth annual meeting of the Association of Surveyors and Civil Engineers of Indiana convened at the office of the County Surveyor at Indianapolis, Jan. 19, 1886. The forenoon was spent in social chat, introductions, etc.

The afternoon session was called to order by the president, R. R. Spencer, who then delivered his annual address. The president gave a history of the organization and progress of the association; it began with six or eight numbers, and now there are seventy-five names on the membership roll. He referred to the advantages that members have derived from association; from the various papers read at the meetings, and from the proceedings of other associations obtained in exchange for their own. He dwelt at length upon the needs of revision of the laws relating to the duties and fees of surveyors and engineers. He closed with an eloquent appeal to the members to do all work with the greatest possible accuracy and maintain an unimpeachable character.

The Executive Committee reported the following persons for membership: James. D. Saunders, J. P. Lesley, George W. Pearce, Will. W. Isley, A. A. Swain.

Mr. Fatout made a verbal report concerning the appointment of Mr. Osmer as a delegate to the Cleveland Conference on the relation of civil and military engineers the government engineering work.

Messrs. Fries and Fatout were appointed a committee to collect outstanding claims for advertising.

The Treasurer, J. W. Craig, made a report showing that $66.66 had been received, $53.50 disbursed, having a balance of $13.16 on hands.

The Corresponding Secretary, L. S. Alter, read his report, showing an expenditure of $34.16 and a receipt of $11.45, a balance of $22.71 being due him which was ordered paid.

Resolutions were passed thanking the officers and others for their interest and assistance. Resolutions were also passed concerning the death of vice-president Hendricks.

The president and Messrs. Pulse, Osmer, and Campbell were appointed a committee to nominate officers and members of the standing committees for the ensuing year.

A committee consisting of Messrs. Pulse, Fatout and Osmer were appointed to revise the constitution and report the same on the first day of the next annual session. Messrs. Morrison, Saunders and Whitten were appointed a committee to prepare a programme for the next meeting.

The Association then adjourned until 7 P. M.

TUESDAY EVENING SESSION.

On reassembling, F. S. Knight, Wabash, Indiana, was elected a member, and I. O. Baker, Champaign, Ills., an honorary member.

John T. Campbell, of Rockville, Parke Co., then gave an address entitled "Topography," which consisted of an account of the method of formation of various topographical features. He gave an interesting account of the effect of the streams in wearing away the hills and filling the valleys; explained how the intraction of floods, falling of leaves and seeds determine the kind of timber predominating in certain localities. He called attention to the fact that the north bank of streams running east and west is very much more sloping than the south one, which he explained as being due to the stratification of the drift formation. He also showed how he tracked a cy-

clone, which occurred not far from three hundred years ago, through three counties, by an examination of the mounds and pits left by the trees which were overturned by the wind. He closed by presenting some illustrations of freaks of trees which he had observed. The gentleman is evidently a close observer, and has spent a good deal of time and labor in elaborating his theories.

WEDNESDAY MORNING SESSION.

Meeting convened at 9 A. M. L. Beckman, Toledo, Ohio, and H. L. Dover, Philadelphia, Penn., were made honorary members; and H. S. Bortner was elected a member.

The election of officers resulted as follows: For President, R. H. Walls, of Greencastle; Vice-President, W. W. Whitton, South Bend; Recording Secretary, H. B. Fatout, Indianapolis; Corresponding Secretary, L. S. Alter, Remington; Treasurer, R. I. Morrison, Knightstown; Executive Committee, J. C. T. A. Pulse, Hardman, John Van Buskirk, W. S. Fries, and G. W. Pierce; Legislative Committee, R. R. Spencer, J. F. Campbell, A. H. Polk, W. A. Osmer, and J. B. Brown; Printing Committee, H. B. Fatout, J. W. Craig, and Wm. H. Isley.

Prof. J. B. Johnson, of St. Louis, Mo., addressed the association on behalf of the Associated Engineering Societies, urging the members to subscribe for the journal, and explaining the advantages to accrue from a closer union of the several engineering associations. At the close of his remarks he was made an honorary member. F. J. Sager, delegate from the Ohio Association, presented the fraternal greetings of that society, and gave a few remarks concerning the growth and usefulness of such associations. A vote of thanks was given to Mr. Sager for his remarks, and he was elected an honorary member. I. O. Baker gave an account of the prospects of the proposed Illinois Association of Engineers, and invited all present to attend and participate in the meeting, to be held in Champaign, February 10th. The new officers then took their seats.

T. A. Hardman, of Franklin county, read a paper on "Highway Bridges." He stated that at present Indiana is paying proportionally more for highway bridges than for anything else in which she invests; the reason assigned was lack of engineering knowledge on the part of those who let the contract. He then explained the ways in which manufacturers sometimes seek to save material at the expense of the strength of the bridge, and gave some simple and very valuable points concerning the inspection of the material and workmanship of highway bridges. He read and explained specifications for highway bridges; and showed how to use the common column formula. He urged those present to gain that knowledge which will fit them to know a good bridge.

It was moved that the legislative committee draft a bill to be presented to the next meeting in reference to laying out and platting additions to cities and towns.

The Recording Secretary read his report, which consisted mainly of the proceedings of the Printing Committee. One thousand reports were printed at an expense of $137.45; $103.50 was received from advertising, with $10 still due. The reports were distributed as follows: Corresponding Secretary, 400 copies; Michigan Society, 175; Ohio, 110; Nebraska, 100; Missouri, 100.

WEDNESDAY AFTERNOON SESSION.

The Association assembled at 1.30, and proceeded to the new State House, as per invitation of the Commissioners. After examining the plans of, and the specimens of materials used, the company was escorted through the building, now in process of erection.

Owing to a lack of time, the visit was very hurried, hence nothing could be gathered concerning the progress or details of the work.

H. B. Fatout, in a paper on "Fees of County Surveyors," called attention to the inconsistencies and ambiguities of the Indiana fee-bill which was enacted years ago, when the principal work to be done was land surveying, while now that is the smaller part, and at present it is a great hindrance to the adjustment of charges. The paper certainly revealed a very bad state of affairs. The paper was very generally discussed by the Association.

The following manufacturers of engineering instruments made displays of instruments:—J. W. Queen & Co. Philadelphia; L. Beckman, Toledo, O.; W. & L. E. Gurley, Troy, N. Y.; these firms were represented respectively by H. L. Dover, W. F. Gurley, and L. Beckman, each of whom in a few remarks called attention to the special merits of their instruments.

F. Hodgman, delegate from the Michigan Society, spoke in behalf of the Manual which that association has prepared and which he promised will be published in less than thirty days.

WEDNESDAY EVENING SESSION.

W. W. Whitten, of South Bend, read a paper entitled "Land Drainage," which began by giving a history of early drainage schemes, on which no engineer was employed and which proved to be ludicrous failures. Attention was called to the defects of the drainage laws.

The speaker then discoursed on the qualifications of a competent drainage engineer at considerable length. He also called attention to two common sources of failure in drainage, viz., insufficient depth of ditch, and an attempt to drain springy marshes by open ditches which do not tap the springs. The difficulties in cutting an open ditch through veins of quicksand were discussed, and various remedies suggested. The question of how to drain marshes in which there was not sufficient fall was considered, closing with the suggestion that possibly wind power might be available to pump the water out. L. S. Alter, of Remington, presented a paper on "Drainage of Swamps." The various dredges used in cutting large open ditches were described, and their relative merits discussed; he then took up the location, depth, width, side-slope, fall, etc., of smaller ditches. He next explained a new tile laying machine which he has been using; it consists of an old fashioned mole-ditcher, drawn with a capstan, having an apron behind on which the tile are laid; pits are dug from the surface to the tile, at points from 100 to 150 rods apart, *i. e.*, at distances equal to the length of the apron; the tile are laid upon the apron through these openings, and drawn into place by the plow.

These two papers were then very fully discussed, most of the members taking part.

Resolutions were passed in reference to the death of General Grant. A vote of thanks was also tendered the Commissioners of the new State House, and all others who have contributed to this meeting.

THURSDAY FORENOON SESSION.

W. A. Osmer, delegate to the Cleveland Conference, made a report of the proceedings of that meeting. The Association confirmed the action of that Convention, and appointed the following committee to act with the General Committee on National Public Works: W. A. Osmer, Logansport; R. R. Spencer, Clarksburg; A. T. Hardman, Brookville; J. P. Lesley, Winchester; Jas. D. Saunders, Evansville.

Jas. D. Saunders was appointed a delegate to the Illinois Convention of Engineers and Surveyors.

Frank Knight, Wabash, read a paper on "Drainage"; E. D. Shreve, chairman of the Drainage Committee of the Ohio Society, gave some impromptu remarks on the same subject.

The subject of "Gravel Roads" was discussed quite generally by the membership. The proper method of subdividing a section, particularly those on the north and west sides of the township, was discussed at length.

The meeting then adjourned, being the best attended and the most interesting and valuable of any the Association has held.

REGISTER OF ATTENDANCE.

R. R. Spencer, President, Clarksburg; W. W. Whitton, Vice-Pres., South Bend; W. S. Fries, Rec. Secretary, Greenfield; L. S. Alter, Corr. Secr., Remington; J. W. Craig, Treas., Greensburg; J. T. Campbell, Rockville; W. A. Osmer, Logansport; J. C. Pulse, Greensburg; E. H. Stradding, Muncie; E. B. Vawter, La Fayette; J. R. Brown, Frankford; R. I. Morrison, Knightstown; J. Van Buskirk, Tipton; T. A. Hardman, Brookville; G. S. Murphy, Shelbyville; H. B. Fatout, Indianapolis; M. A. Downey, Rushville; J. D. Saunders, Evansville; G. W. Pearce, Martinsdale; W. H. Isley, Shelbyville; J. P. Lesley, Winchester; A. A. Swain, Milroy; Chas. Sturgeon, Columbus, O.; W. F. Gurley, Troy, N. Y.; R. H. Walls, Greencastle; J. J. Daniels, Rockville; I. O. Baker, Champaign, Ill.; H. S. Bortner, Albion; Henry Grubt, Ferndale; G. M. Cheney, Logansport; Frank Knight, Wabash; John Fisher, Crown Point; J. M. Waugh, Crawfordsville, L. Beckman, Toledo, O.; C. Smith, Delphi; J. B. Johnson, St. Louis, Mo.; D. E. McDowell, Columbus, O.; A. D. Williams, Anderson; N. T. Burk, Anderson, J. D. Fenwick, Daleville; F. Hogdson, Climax, Mich.; H. L. Dover, Philadelphia; E. D. Shreve, Ohio.

The Inland Navigations of Europe.

The Institution of Civil Engineers commenced during their sessions of 1882-83 the practice of giving a course of lectures, delivered by members on subjects of engineering interest. The first series of six lectures was on the *Practical Applications of Electricity*. The second series delivered in 1883-84 was on *Heat and its Mechanical Appliances*. And the third delivered last winter was on the *Theory and Practice of Hydrodynamics* and consisted of the following lectures:

1. *Physiography*, by John Evans.
2. *Water Supply*, by Dr. Wm. Pole.
3. *Water Motors*, by Professor W. C. Unwin.
4. *Inland Navigations in Europe*, by Sir Charles A. Hartley.
5. *Tides and Coast Works*, by Thomas Stevenson.
6. *Forms of Ships*, by Sir E. J. Reed; all members of the Institution.

This notice will be confined to the lecture on "Inland Navigations in Europe."

The lecturer gives no attention to either the relative costs of transportation on Canals and Railroads, to Ship Canals, or, except in the instance of the proposed North Sea and Baltic canal (see ENGINEERING NEWS, December 26th, 1885), to projected improvements.

The lecture commences with the waterways of the United Kingdom, going thence to Russia and, following the north shore of Europe, around to Italy and then describing the Danube, condensing a vast amount of useful information, the acquisition of which must have been very difficult.

The lengths of the various navigations is given below:

There are also 580 or more miles of navigation on the lower Danube making the total waterways of Europe, with England, approximately equal to 42,167 miles to which may be added 38,000 miles of raft navigation in Russia.

Probably with the understanding that the data were well known to his hearers, very little is said of British canals and rivers. The Thames, 218 miles in length, is navigable by canalization to Lechdale, 24 miles from its head. London Bridge, 48 miles from its mouth, limits the navigation for ships or vessels with fixed masts.

	Canals.	Navigable rivers.	Total.
England and Wales	2,919	1,413	4,332
Scotland	.....	.....	355
Ireland	.....	.....	755
Total Navigation in United Kingdom	.....	.....	5,442
European Russia	.....	.....	1,900
Sweden	.....	.....	300
Germany	1,250	17,000	18,250
Holland	930	340	1,270
Belgium	2,634	700	3,334
France	.....	.....	7,432
Spain and Portugal	130	300	430
Italy	435	690	1,125
Austria-Hungary	226	1,878	2,104

The total area of the Thames basin is 5,162 miles; Connecticut has an area of 4,750 miles. The fresh water discharge at Crossness, 13 miles below London Bridge, is 2,000 cubic feet per second, and at an ordinary spring tide the land water is to the salt as 1 is to 26. The carrying power of barges on the British canals varies with but few exceptions from 20 to 80 tons. Mr. Marten, in the discussion on Mr. Conder's paper, gives the load of the ordinary canal boat as 30 to 40 tons, and according to the last mentioned paper there are three canals with locks 12 to 10 feet wide, nine with locks 10 to 8 feet wide and twelve with locks 8 to 6 feet 10½ inches wide; there is on the average a lock every 1½ miles.

These figures seem of interest as the low estate of British canals is often used as an argument against improvements of natural or artificial waterways in this country, whereas it is merely an argument against small canals.

The average working expenses on all English waterways are given as 0.26 *d.* per ton mile, excluding interest on capital; this at 2 cents per *d.* would be 5⅛ mills per ton mile, while on the Erie canal and Hudson river, (boats carrying 240 tons going full one way and about one-quarter full the other) the freight received for wheat this year has been 2½ mills per gross ton mile. From Duluth to Buffalo, 1,030 miles (boats carrying 2,500 tons) wheat was carried at the rate of $\frac{1}{100}$ of a mill per ton mile, with one lockage on the way. The freight from New York to San Francisco (16,030 miles) is $8 per ton or $\frac{1}{2}$ mill per ton mile, but the cheapest known freight is on coal from Pittsburg to New Orleans said to be $\frac{1}{4}$ of a cent per ton mile or $\frac{1}{200}$ of a mill.

The Caledonian canal, 60¼ miles long, of which 23 miles are canal and the rest lakes, passes vessels 160 feet in length, 38 feet beam and 17 feet draft. This canal was commenced about eighty years ago by Telford, and the dimensions adopted were governed by the size of "His Majesty's 32 gun ships." Mr. Forrest, (Secy. I. C. E.) gives the size and speed of vessels navigating this canal as follows: Passenger steamer plying regularly, length over all 153 feet, breadth over paddle wings 35 feet, draft 5 feet, speed 6 to 7 miles in canal, and over 7 on lakes; cargo propellors' length 155 feet, breadth 25½, draft 12 to 14 feet, speed 6 miles per hour in canal, and 10 to 12 on lakes. The cost of this canal was about £1,000,000. The average cost per mile of canals and canalized rivers in England and Wales is £6,052, the maximum the Regent's canal, £120,000.

Nothing is said of the Manchester Ship canal and other projected large canals in the United Kingdom.

In Russia the Volga, which is about 1,500 miles long from Nijni Novgorod, is the principal river both in the size of its drainage basin (563,000 square miles), the length of its navigation (7,200 miles with its tributaries) and in its trade which employs 600 steamers. The Volga has a drainage area of 90 per cent. greater than the Danube, but has a discharge of less than two-thirds of the latter river, and gives much trouble from its sand bars, particularly at the numerous mouths, over seventy, by which it discharges into the Caspian Sea, which has an area of 160,000 square miles, and is 84 feet below the Black Sea.

The greater part of Russia is slightly elevated above the sea, and is interspersed with rivers, lakes and canals, so that a light draft screw steamer of 150 tons has sailed from the Caspian Sea via the Volga, the Marie system of canals, Lake Onega, the river Neva, and thence round Europe to Odessa. There are also canals by which small vessels can pass from the Baltic to the White Sea.

The St. Peterburg canal which has lately been opened was commenced in 1878 by Messrs. Morris and Cummings of this city; it is 18 miles in length, has a floor width of 276 feet, and an actual depth of 20 feet to be increased to 22. It connects St. Petersburg and Cronstadt, which were separated by a bar with only 8 or 10 feet of water on it.

Sweden abounds in lakes, which are connected by more than 300 miles of canals, one of which, 48 feet wide at the bottom, 90 at the surface and 10 feet deep, is used by steamers and passes over a summit 300 feet high, employing 74 locks. The time of navigation is about the same as on the Erie canal, seven months.

Germany, considering its area, has neither large rivers nor important canals. The principal rivers are the Elbe and Rhine, the first draining an area of 55,000 square miles; its depths are: from the Bohemian-Saxon frontier to Anhalt 163 miles 5 feet, from Anhalt to Havelberg, 103 miles, 5 to 6 feet, and from Havelberg to Hamburg, 122 miles, 6 to 6½ feet.

The commerce of the upper Elbe is conducted by chain towing, 28 tugs, 136 to 150 feet long, 24 wide and 18 inches draft, being employed. The average tow is 4 to 8 barges, and the *cost* of transporting a cargo from Hamburg to Dresden, 350 miles in barges of 150 and 400 tons, is respectively 11*s.* 9*d.* and 9*s.* 4*d.* per ton up stream, and 4*s.* 4½*d.* to 2*s.* 9½*d.* down stream, or 8/10 to 6/10 miles per ton mile up stream, and 3 to 1⅞ miles per ton mile down stream. "These figures are given on the authority of Mr. Bauer, and have been selected as a fair type of the present method of traction with its precise cost on one of the best conducted inland water routes on the continent." There is an internal navigation by which barges drawing 3 feet and carrying 110 to 125 tons can pass from the Elbe into the Oder and Vistula.

The Rhine has a drainage basin of 76,000 square miles, and a length of 850 miles. It is navigable from Bâle 537½ miles to its many mouths on the coast of the Netherlands.

The principal tributaries of the Rhine are on the right bank the Neckar and Main, the latter being navigable for barges for 200 miles. The Ruhr, which joins the Rhine on its right bank, has a navigation of 46 miles, with eleven locks 147 feet long and 18¼ feet wide, carrying barges of 160 tons drawing 3½ feet. Railroads are now securing the greater part of the freight, and it has lately been proposed to enlarge the locks. This river is noticeable for the difference between high and low water discharges, the minimum being 300, and the maximum 58,245 cubic feet per second, or two hundred times its minimum volume. This difference is exceeded by the Loire 1 to 330, and and by the Duro, where the discharge varies as 1 to 1,500. The mean discharge of the Rhine is 80,000 cubic feet per second, and it is connected by canals with the Rhone, Saône, Scheldt and Danube.

The canals of Holland are generally 60 feet wide at the bottom and 6 feet deep. (The lecturer's figures have been given for the length of water courses in Holland, but Van Kirkwyk gives the length in 1874 as, rivers 1,230 miles, canals 1,795.) The old North Holland canal from the Texel to Amsterdam, 52 miles with locks, 213 feet long, 51½ wide, with 18 feet on mitre sills, has been superseded in its importance to Amsterdam by the North Sea canal, which is 88.6 feet wide on bottom, and 23 feet deep, with two locks at the sea end, one 390 by 60 feet, and the other 227 by 40 feet. At the Zuyder-Zee end there are three locks of different sizes.

The river system of both Holland and Belgium is so intricate that the lecturer referred to a map sent him by M. Dirks, Engineer-in-chief of the Waterstant, to give his hearers an idea of their relations to each other.

The French rivers are connected by means of canals with each other and with the Scheldt and Rhine.

The Seine 480 miles long, has a mean discharge of 24,500 cubic feet per second from a total area of 30,000 square miles. It first becomes navigable near Troyes, about 350 miles from its mouth; its principal tributaries are the Yonne and Eure on the left, the Marne and Oise on the right bank.

The movable dams, a development from our early bear trap dams, on this river and its tributaries, have called the attention of all engineers to it and its improvements. From Paris to Rouen 150 miles by water and 72 in a straight line the average fall is 6 inches per mile. It is proposed by the decree of 1878 to increase the draft to 10½ feet, so that vessels of 800 tons burden can reach the Pont de la Concorde at Paris at all times. The locks already built have an average rise of 8 feet 3 inches, the highest at Martot being 13 feet 9 inches. All the dams having movable weirs. The traffic on the Seine between Paris and Rouen is given on the authority of M. Krantz as 180,000,000 ton miles, more than one eighth of the whole water traffic of France. This gives for the amount of freight on the Seine 1,000,000 tons; the up and down freight between New York and Buffalo averages about 3,357,000 tons and the ton mileage to over 1,650,000,000.

The Loire whose fluctuations have been referred to above is not available for boats of large burden, and the Garonne which is connected with the Mediterranean at Toulouse by the Canal du Midi is also subject to troublesome floods.

The Rhone, 635 miles in length, draining an area of 28,900 square miles and having a mean discharge of 60,600 feet per second, is navigable to Lyons, 200 miles. The failure to improve the mouth of this river by jetties, and the subsequent construction of a canal was referred to in the discussion between the advocates of a canal and jetties at the mouth of the Mississippi.

France has a network of canals with a uniform depth of 5 feet 3 inches and a bottom width of 33 feet that have been located with the view of giving the cheapest and most direct means of distribution between the great centers of trade and production; those of them, which are classed as principal lines of communication, by a law of 1879, are to be deepened to 7 feet and 4 inches and the same law prescribes that all locks shall be 126 by 17 feet with sufficient water on their mitre sills to allow the free passage of boats drawing 6 feet 6 inches.

The total navigation, river and canal, open and to be opened is given as 8,882 miles and up to 1878 £43,608,516 had been spent on 7,069 miles and it is proposed to expend £40,000,000 more in still further improving them.

The most celebrated of the French canals is that of Languedoc, now a part of the Canal du Midi, which was built by Riquet 1667—81, 80 years before the opening of Brindley's Bridgewater canal; its length is 171 miles rising from Toulouse on the Mediterranean by 74 locks to a height of 600 feet and descending to the Garonne by 26 locks.

The length of railroads in France in 1880 was 15,141 miles and the ton mileage was 6,600,000,000. Length of waterways 7,432 with 1,541,000,000 ton mileage, or about that of the Erie canal and Hudson River route; highways 23,264, ton mileage 903,000,000.

The navigation of Spain, Portugal and Italy is inconsiderable. The Po, 350 miles long, drains an area of 29,000 square miles. The discharges of the Po are minimum 7,558, mean 60,735, maximum 181,580 cubic feet per second. At Ferrara, 50 miles from the sea, the low water level is only 9 feet above tide and high water 37 feet and the top of the embankments confining the water is higher than the roofs of the houses.

The Tiber, 240 miles long, drains 6,500 square miles with a mean discharge of 10,800 cubic feet per second. Rome is 24 miles from the mouth of the river and is navigable for vessels of 140 tons, and with some difficulty 60 or 70 miles further for those of 60 tons.

Though the Italians were the first people in modern Europe to plan and execute canals (Leonardo da Vinci being said to have invented locks), their canals are principally undertaken for irrigation, the Canal Cavour being the largest of these.

The Danube, on which the navigation of Austria-Hungary and the Danubian principalities depends, has a total length of 1,750 miles and drains 316,000 square miles.

Its principal tributaries are, on the right bank, the Inn, Drave and Save, and on the left bank the Theiss, Olta, Sereth and Pruth. Together these seven streams have a length of 2,900 miles and drain one half of the Danube basin.

The Danube is navigable for flat-bottomed boats carrying 100 tons at Ulm, 130 miles from its source. Between Ulm and Passau it is joined by the Ludwig canal, 110 miles long and 7 feet deep, which connects it with the Rhine.

Haulage on the upper and central Danube is performed by steam-tugs and chain-tugs. The chain employed weighs about 24 tons per mile, breaking strain 30 tons and cost laid down about £600 per mile. Traffic on the lower Danube, which commences at the Iron Gates, is mostly conducted by the Imperial and Royal Danube Steam Navigation Company.

The upper and central river has been improved by works of correction and by the new channel at Vienna; a cut 10 miles long, 1,000 feet wide, and 10 to 12 feet below ordinary low water level, which involved the excavation of 15,600,000 cubic yards of sand and gravel, and costing £3,250,000, made to prevent the flooding of Vienna and to improve the navigation of the river.

The so-called cataracts of the Iron Gates have a length of 5,070, with a fall of 1 in 507 at high and 1 in 307 at low water. The distance from the foot of the Iron Gates to the Black Sea is 580 miles by the river, and the elevation of low water is 118 feet above tide.

For more than a quarter of a century, projects for the improvement of this part of the river have been under consideration, William J. McAlpine, Past President of the American Society of Civil Engineers, having been engaged as consulting engineer. The present plan is to cut a channel through the reefs of rock and to construct a lateral canal with lift locks with a rise of 14½ feet.

Eight miles below the Iron Gates the bridge built by Apollodorus, A. D. 103, still shows at low water 13 of its 20 stone piers.

Ninety-one miles below the Iron Gates at Widin the river leaves the mountains, and thence flows through low or comparatively low ground.

Sir Charles gives a very concise account of the improvements of the Sulina branch and its mouth, and sums up the effect of his improvements there as an increase on the bar, of from 8 or 10 feet to 20½ feet without dredging; the increase of trade, from 680,000 gross tons in 1859 to 1,530,000 tons in 1883, lowering the charges on shipping from an average of 20*s.* per ton for lighterage to 2*s.* for "commission dues."

He concludes, "whatever, for instance, may be the result of the Liverpool and Manchester scheme now before Parliament, it is evident, I think, that a grand future is open to works of that class; and I venture to predict that the improvement of water communications between the sea and inland towns of importance by means of canals or deep, open channels, planned so as to *aid nature* in maintaining their increased depth, will continue to go on briskly after the last ghost of a practicable inter-oceanic waterway has been finally laid."

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THE Congressional Committee on Railways and Canals has recommended the expenditure of $6,000,000 in the improvement of the Erie Canal; $1,000,000 to be spent annually.

THE editor of our esteemed contemporary, the *Iron Age*, was an honored guest at the annual meeting of the American Society of Civil Engineers, where, in return for his brilliant after dinner speech, he was apparently given some valuable pieces of misinformation, as: "Chief Engineer Church proposes to cover the new aqueduct for a distance of 31 miles from this city with a brick arch." This is an improvement on the proposition once made to roof in the old aqueduct with boards as a brick arch would be much more permanent. And "The dynamite is kept frozen to *increase its explosive powers*, and when needed it is set near the steam pipes and gradually thawed out." We wonder that even Secretary Bogart's well known hospitality should have produced the above in the mind of the President of the Mining Engineers. It might also be mentioned that the "Rowland Prize" in the American Society of Civil Engineers is not awarded for the second best paper; it being intended by its founder to cover a different class of papers from those specified by Mr. Norman.

WE see that Commissioner of Public Works Squire is eking out a shorter appropriation than he asked for by cutting down salaries and removing employes; and, as is usual when an economical fit strikes a corporate or municipal body, the civil engineers bear the burden of the "cut."

With the "official salary list" of New York peppered all over with "commissioners" at $8,000 and "clerks" at from $3,000 to $6,000 per annum, it would seem that the necessary amount could have been made up by a reduction somewhere in that direction; for example, we do not believe that the public service would have suffered one jot by a discount of about 50 per cent. in the salary account of Mr. Commissioner himself, however startling and unusual such action might appear in the eyes of a professional place-holder.

We fear that engineers, as a rule, pay too much attention to the technical business, for which they are paid, and too little to the importance of having a strong political "pull" that would secure for them a good position regardless of considerations of previous training or general fitness.

THE Relief Fund movement started by the Penna. R. R. Co. does not seem to be very popular among the employes it is proposed to benefit. By the scheme of this fund, membership costs $30 per annum, to be deducted from the monthly pay. In case an employe is killed on the road, his family or heirs get $2500; but if he dies a natural death the amount awarded is only $500.

The men make the objection that the annual fee is too large, and that they can obtain equal benefit from outside corporations by the payment of a $13 annual fee. The real purpose of the Relief Fund is supposed to be the lessening of tendency to strikes among the men.

THE report of the Union League Club committee on the Quaker Bridge Dam is given in our "Water" column. While some of the points made seem sensible and perhaps wise, we are not sufficiently familiar with all the details of the subject to either finally approve or condemn,—saving that they leave about 115 square miles of the possible rainfall area unstored.

The remarkable point in the report lies in the final clause where the committee advise a new examination of the question by engineers of "capacity, judgment and experience," and especially taboo all those engineers who have given any opinion upon the proposed dam from serving as such experts.

The Union League Club seems to be preparing trouble for the Commission in the selection of these experts; for if the engineers who have already sat in judgment upon this very scheme, —Messrs. Chesbrough, Francis, Adams, Church, Davis, Fteley, etc.—are not men of "well-known capacity, experience and judgment" in such matters, where will the Commissioners or even the Union League Club find their superiors? We trust that the Union League does not propose to recommend the importation of its engineering experts.

APROPOS of snow removal, referred to in another column, we notice that a foreign correspondent of a New York daily says, that on the occasion of a late three-inch snowfall in London, the intelligent vestrymen of Hampstead parish, instead of attempting to remove it, rolled the moist snow with heavy steam road rollers. As a sharp frost set in about the time this bit of parochial engineering was completed, the citizens, the next morning, found their principal thoroughfares a glaring mass of smooth ice, alike impassible to cabs, omnibusses and all horseflesh, and nearly so to pedestrians.

We can not help wondering what the municipal authorities of London or Paris would do with an old-fashioned American snow storm a foot or two deep on a level. We fear that salt and road rollers combined would fail to do justice to the situation.

The Engineer, of January 15, in speaking of snow removal, berates the London authorities for their lack of interprise and judgment in the treatment of a considerable snow-fall.

It says that in Russia everything is done to convert the fallen snow as rapidly as possible into a good, hard and even road. Water is thrown over it where it seems loose and rotten; it is compacted with wooden shovels and then transverse grooves are cut in it to make a foothold for horses, and finally sand is thrown over it. All horses are rough-shod by order and the use of salt is forbidden. This Russian snow-fall lasts, however, for five months in the year.

The Engineer suggests that rotary sweeping machines with wire brushes would have a beneficial effect in reducing the rough lumps of snow to a fine powder, and thinks that the American snow-plough should be adopted on London streets. The trouble in London seems to be that the snow removal is in the hands of the various vestries who cannot be relied upon to organize on the spur of the moment an efficient gang of cleaners.

THE London *Railway News* says that the progressive or military faction in the Chinese capital is steadily pushing the scheme for railway construction. The North China *Herald* states that a line towards Shensi may soon be commenced. The chief opposition now comes from the Board of Revenue. It is also reported that the prospects of an American Syndicate obtaining the contract for Chinese railways is improved by reason of the unfavorable reception accorded to Li Fong Pao, the late Chinese Embassador in Berlin, who is credited with being the chief support of the German syndicate. The scheme before the Chinese Government will require a capital of about $200,000,000, and owing to the feeling against the intrusion of a foreign syndicate, it is considered probable that the government will attempt to build its own railways by engaging foreign engineers in its own service.

The Panama Canal.

An engineer, lately returned from the Isthmus, gives us the following information, which through his own observation and rather exceptional facilities for gaining knowledge, he believes to be correct:

About 12 per cent. of the total work of excavation is now complete; no more than this.

The sickness and mortality does not decrease. Engineers, who have safely passed through two years of the climate and had a visit to Paris, either through too great confidence in their strength of constitution or some other cause, are very liable to die shortly after their return. The semi-fluid mud thrown up by the dredges is at times very offensive to the smell, and is thought to be particularly dangerous. No statistics as to the deaths among the laborers were given.

The engineering at present is in charge of a division engineer, Binau Varillà. M. Boyer is expected soon as chief. M. Houtan is not expected, and it is understood that M. Dingler will remain in Paris as consulting engineer. M. de Marteau or Herr von Hammer, who has become a contractor, has brought out some new excavators, a modification of the Couvreux, to which are attached endless rubber carriers, some 300 feet long; these are supported by a light trestle and are expected to save labor.

The Couvreux Excavator has been improved so that it is worked from a single track of two rails instead of requiring three rails as before; this has been accomplished by putting the water tank on the opposite side from the endless chain scoop or bucket

carrier. As now arranged, it will excavate about 500 cubic yards per day, which is dumped into a hopper, about 15 feet above the service track, and from thence into a train of Belgian side dumping cars and hauled away to the waste bank. It is thought that it will be impossible to keep the track for this excavator in such surface as to admit of its use during the rainy season.

Near Panama they are putting together some endless chain bucket dredges built in Belgium and England from plans by the canal engineers. These which are to be used in the Rio Grande are worked by gearing, and the mooring chains, instead of leading from the deck, are carried down through long vertical hawse pipes about 8 feet in length, at the bottom of which are wheels for the chains to pass under, as they are led out horizontally to the anchorages; this plan is adopted to prevent interference with the dump scows as they are brought alongside, but as the tide rises and falls through 18 feet on that coast there will probably be at times a very heavy strain on the bottoms of the hawse pipes. These dredges are being mounted near Las Bocas by days labor, it is said at a cost of $75,000 each!

The American dredges employed by the Franco-American Dredging Company are said to be a failure, not through inability to do the work or liability to break down, but through the expensiveness of the dipper man and engineer in that sickly climate; with the chain dredges on the contrary, they employ a Jamaica negro as engineer and only one intelligent workman who instead of having to work, mostly sits in the shade watching to see that nothing goes wrong.

There is dissatisfaction with the mode of letting contracts at the Panama end. The work is let without classification at $1.70 per cubic metre, and the earth, is in instances sublet at 80 cents; it is claimed that the 90 cents profit to the contractor will enable him to recoup his bondsman with profit to himself, if he abandons the work on reaching rock, and those who claim to be reliable contractors, are afraid to bid under the circumstances.

Rock excavation on the Isthmus is conducted in primitive style as they use neither power drills, high explosives nor electricity for firing. Submerged rock is surrounded by a dam and the water kept down by pumps till a depth of about 12 feet is obtained below which they have not gone to any extent. Strenuous efforts are now being made to remove two masses of rock in the canal, near Gatun, of about 20,000 cubic yards each, as their removal will give de Lesseps an addition to his sail up the Atlantic end of the canal of some kilometers.

Almost every interest in the Isthmus is dependent on the report of M. de Lesseps' commission, and the local pressure will be as direct and powerful as is possible—for the merchants, of Colon and Panama, fearing that the Columbian Government would succeed in imposing import duties, have laid in very heavy stocks of all kinds of goods, so that Panama is said to be at present the cheapest market in the world for such goods as have been sold to canal employes, and if Count de Lesseps cannot get more money, many of those goods must pay freight to another market.

European Waterways.

We print on another page a very full abstract and notice of Sir Charles A. Hartley's lecture before the Institution of Civil Engineers, on the inland navigation of Europe, a lecture that was well worthy the commendation it received from the proposers of the vote of thanks at its conclusion. Our country is greatly interested in the problem of internal navigation, as, though our railroad and canal freight rates are lower than on the European continent and in Great Britain, our production is greater and is distributed over much greater distances so that, as our reviewer shows, the ton mileage on the route from Buffalo to New York is greater than the ton mileage on all the rivers and canals of France, for the improvement of which, according to Sir Charles, $215,000,000 had been spent up to 1878, and $200,000,000 more is proposed to be expended, while the Erie canal cost only $32,000,000.

Our annual bill for river and harbor improvements keeps the subject constantly before us and lately Mr. Sweet's able paper on the "Radical Enlargement of the Erie Canal," read before the American Society of Civil Engineers, with the success of the Mississippi jetties, the demand for the Hennepin canal, and the wonderful increase of navigation, following the deepening and enlargement of the lock at St. Mary's Falls, have given the subject a renewed interest in this country. The completion of the Suez and North Sea canals has, as our readers have been advised, greatly increased the interest of Europeans in the cheapened transportation resulting from improved waterways, as shown in the deepening of the Seine and other rivers in Europe, and the projected Manchester, and North Sea and Baltic ship canals, besides other projects more or less inchoate.

In our issue of December 5th last, we referred to the prompt effect the passage of the Manchester ship canal bill had had in reducing railroad freights between Liverpool and Manchester, and on the completion of the canal they will be still further reduced, as by the terms of the charter they can not be more than half the dock and railroad charges obtaining at the passage of the bill.

Very little is said of ship canals, as the North Sea canal had lately been described to the Institution by Mr. Hayter; nor would the rules of the Institution allow the discussion of the projected Manchester ship canal. So the lecture is greatly on barge and boat routes and it will be of interest to those, who knowing that canal transportation in England has so insignificant an effect on the distribution of that country, but do not know of the small size of the locks and their frequent recurrence (1 to 1½ mile on the average,) to read the eminent lecturer's words "On the great inland navigations on the Continent.' The permanent acquisition of even a single foot of additional depth between great trading ports in the same, or in an adjacent river basin, is considered of immense importance, and worthy of being attained at a great cost; and striking examples of this assertion in France and Germany, I have endeavored to lay before you. In no other way than by deepening existing channels and by acquiring new ones of comparatively great depth can a wholesale and wholesome competition with railways for the transport of heavy goods be brought about."

It is a well established fact that the freighting capacities of channels vary as the cube of their depths, and Sir Charles, quoting the *costs* of freight on the Elbe, says "on this river it has been found, as elsewhere, that vessels of large tonnage pay best," and, instancing barges of 150 and 400 tons, gives the cost per ton up stream, in the larger 81 per cent. of the smaller, and down stream 60 per cent., or a reduction of costs of 19 and 40 per cent. And Mr. Sweet in his paper, quoted above, says "that the increased capacity of the boats on the Erie canal from 70 to 240 tons, made possible by the enlargement, reduced the cost of transportation 70 per cent."

About the commencement of the century, the Clyde was fordable below Glasgow, and though some of its inhabitants objected to the measures, it is now said to be "the best improved stream in the world" and by a table printed in a late number of the *Iron and Coal Trades Review*, the exports of thirteen articles, enumerated, have during the ten years ending 1884 increased in value from £2½ millions to over 4 millions, while the export from Liverpool of the same commodities has only increased from £16 millions to 17½ millions.

The *Iron Age* lately published the following table, showing the shipments to Calcutta for thirteen years, via the Suez Canal and the Cape of Good Hope, on the authority of Duncan & Co., of Calcutta.

Shipments to Calcutta via Suez Canal and Cape of Good Hope:

	Via Suez.	Via Cape of Good Hope.	Total.
1870	44,000	390,000	434,000
1871	111,000	486,000	597,000
1872	133,000	374,000	507,000
1873	136,000	352,000	488,000
1874	164,000	275,000	439,000
1875	152,000	340,000	492,000
1876	208,000	501,000	709,000
1877	348,000	587,000	935,000
1878	228,000	397,000	625,000
1879	204,000	391,000	595,000
1880	290,000	467,000	757,000
1881	390,000	399,000	789,000
1882	487,000	440,000	927,000

In this case a more expeditious route has built up a commerce of its own about equal that it found on the longer route without apparent injury to its opponent.

It is in view of such facts that Holland built the deeper and more direct North Sea canal, although there was an open sea navigation and a canal already; that Germany proposes the North Sea and Baltic canal, also against an existing canal and natural navigation, and the Manchester Ship canal has been projected against shallower waterways, viz.: the Irwell navigation and Brindley's Duke of Bridgewater's canal.

In our country the improvement of waterways, instead of taking the course predicted in Europe, will probably take the direction of improving our rivers and building and enlarging canals. These watercourses by allowing the transportation of bulky and low priced products will develop a direct and return trade that will increase the traffic of the railroads that are parallel to them. Care should be taken in planning these improvements that no restricted plans should be adopted, tending to make the enterprise a failure by insufficient depth or width of channel.

Protection of the Dry Goods District of New York.

At the meeting of the Commissioners of the Sinking Fund, held January 9, reports were submitted upon plans and proposals of various companies for supplying water in sufficient quantities for the extinguishment of fires in the dry goods district of New York City.

The various plans suggested are summarized as follows, in the report of Messrs. B. S. Church, Chief Eng. Aqueduct Commission, G. W. Birdsall, Chief Eng. Croton Aqueduct, and Julius W. Adams, Consulting Eng. Dept. of Public Works, who were selected as experts by the Commissioners:

Metropolitan Water Co.—This company propose to cover the city from the Battery to 59th street; build a masonry water tower 350 feet high and 100 feet diameter at Union Square, or a stand-pipe 350 feet high, 80 feet diameter, and with a capacity of 12,000,000 gal-

lons. They are to have a triplicate pumping plant of a total of 1,750 horse-power; to lay 104 miles of from 8-inch to 36-inch pipe with hydrants complete. They would pump from the North river and supply, from about 6,000 hydrants, from 112 to 512 streams of salt water through from 100 to 2,000 feet of hose to heights of jets ranging from 185 at the Battery to 219 feet at 14th street and Avenue A. The capacity of the plant would be 40,000,000, and all work to be done by the company, but under an arrangement with the city for the payment of a yearly hydrant rental when the works are completed. This company propose to dispense with all steamers and the water now wasted in flushing gutters, sewers, etc.

The engineers conclude that in view of the introduction of the Croton new supply, about the same time the metropolitan scheme would go into operation, the sanitary advantages claimed will have no value; and as a fire service alone its cost is too great as compared with simpler methods. They do not consider the abolition of the fire service by portable engines either possible or desirable in a great city like New York.

The United States Water Supply Co. This company make two propositions. 1st. By driven wells to supply from 5 to 10 million gallons of water in 24 hours at a pressure of 80 pounds for the dry goods district; the lands and buildings at the company's expense, but all connections beyond pump outlets at the expense of the city. The cost would be at the rate of $125,000 per annum per million of gallons. 2nd. To furnish a daily supply up to 30,000,000 gallons anywhere in the city for $50,000 annually per million gallons daily.

The engineers think the first proposition feasible, but doubt the ability to supply 30,000,000 daily. The cost too is objectionable.

New York City Water Co.—This company propose to sink a large well at a point where large bodies of saturated gravel are known to exist, and to deliver at least 5,000,000 gallons daily. Above the well will be four tanks of a capacity of 5,000,000, and four engines and pumps (two reserve) will force the water through 10 miles of 8-inch to 30-inch pipes, laid in the district bounded by Chambers, Centre, Bleecker Sts. and West Broadway, and supplied with any desired number of hydrants. The pressure at the pumps to be 300 pounds, and at the nozzles 80 to 200 pounds per square inch. At intervals of several blocks, water-towers of cast-iron will be set up with hydrant on roof. Land and all connections and fixtures at the expense of the company, the city to pay a fixed hydrant rental, not less than $150,000 annually. Payment ceases on failure of wells.

The engineers consider this the most feasible plan presented, and as efficient and economical for fire protection in the dry goods district.

The Greathead System.—By this it is proposed to utilize the volume of water in the Croton pipes, already more abundant than in any other city district in any large city known, and to supply the requisite pressure from an auxiliary system of pipes of small diameter placed contiguous to the Croton mains. The auxiliary system is to be tested to 2,000 to 2,500 pounds per square inch, and when in use a pressure of 700 to 800 pounds furnished at the hydrant. The hydrant is peculiar in form, acting on the principle of the Gifford injector, and when the small volume at high pressure enters a large volume jet from the Croton main, it communicates to the whole current a velocity greatly in excess of the normal Croton pressure.

The experts admit that this device is ingenious, but think the use of a pressure so great as 800 pounds would be embarrassing, and that the resulting pressure at the nozzle of the hose, from the best experiments thus far recorded, would not be equal to the demands of this especial service.

Holly System. By this system it is proposed to increase at will from the pumps the fire pressure in the delivery pipes by an independent line of mains, hydrants, etc. The proposition is to pump from the North River, lay independent mains, hydrants, etc. in the district bounded by Hudson River, Cortlandt street, Broadway, Tenth and Christopher streets; to supply a jet of 135 feet high from hydrants, for the sum of $1,487,000 to be paid as work progresses. For four other districts a like propositon for a total of $5,950,000, with a total supply of 36,000,000 gallons daily.

This scheme is old (1879) and too vague as to ultimate cost to the city.

The Ramapo Scheme. There is no special proposition from the promotors of this scheme, and the cost of bringing water from the other side of the North River is too great to be considered here.

The Fanning Water Supply from the Adirondack.—Notwithstanding the undoubted merits of this plan, legislative authority is yet awaited and six years or more would elapse before this source could be made available.

The report of the engineer experts was adopted, and it was resolved that the Corporation Counsel draw up and submit to the Board a form of contract with the New York City Water Co., in conformity with their proposal above.

Snow Removal by Salt in Paris.

Le Génie Civil, of Jan. 16, contains a description of the use of common salt as an aid in removing, or liquifying the snow on the streets of Paris. We make the following abstract:

Machines were first tried for spreading the salt evenly, but it was found that this could be more effectually and economically done by hand or by a shovel. The common rock-salt is used costing at the depot in Paris about 31 francs per ton. It is stored in the various depots of the street department, and as soon as snow falls each of the workmen in the city service spreads the salt on the especial portion of the roadway under his care. In two or three hours after the salt is scattered, the liquifaction of the snow is sufficiently advanced to permit the sweeping of the streets either by hand or by machines. The salt is very seldom put upon the footways, which are cleansed over a certain width by the abuttors, because such application would result in a very disagreeable mess under foot.

The city of Paris spent about $44,000 in removing the snowfall of December 8 and 10 of last year, with a depth of fall of from 3 to 4-inches. The amount of salt used was about 125 grammes per square metre, and the total cleaning cost 3 to 4 centimes per square metre, about one-eighth of the cost being for the salt.

During the severe winters of 1879 and 1880, when the total snowfall was 24-inches for the first year named and 16-inches for the second, the cost of its removal per *centimetre* (0.39 in.) was, in 1879, 60,000 francs, and in 1880, 50,000 francs. To the month of January 1885, this expense had decreased to 25,000 francs, the saving being mainly accredited to the use of salt in the proportions first named.

It is found that salt damages the macadam pavement, and from all stone pavements the snow is scraped up and swept into the gutters, whence it is carried into the sewers. Carts are only used in the case of a heavy snowfall (unusual in Paris), and their contents are dumped into the Seine, or into such sewers as have a very considerable velocity of flow.

The Aqueduct Commission and its Engineers.

From the official list of officers and subordinates of the city government of New York, printed in *The City Record* of Jan. 30, we select the Aqueduct Commission and its engineers, down to and including the grade of leveler, with the expectation that the information will prove interesting to the friends of the parties named.

Aqueduct Commission.—James C. Spencer, William Dowd and C. C. Baldwin, Commissioners; salary, $8,000 each. James W. McCulloh, Secretary, $6,000.

Bureau of Chief Engineer.—Benjamin S. Church, Chief Engineer, $10,000; Joseph P. Davis, Consulting Engineer, $6,000; Alphonse Fteley, Deputy Chief Engineer, $7,000; Thomas Franklyn and Walter S. Church, Asst. Engineers, $2,400; Ira A. Shaler, Leveler, $1,200; Frederick S. Cook, Asst. Eng. in charge of draughting department, $2,400.

Bureau of Engineer of Construction.—Henry S. Craven, Engineer of Construction, Tarrytown, $6,000; Charles S. Gowen, Sing Sing; John B. McIntyre and John M. Wolbrecht, Tarrytown; Alfred Craven, Dobbs Ferry; Edward S. Gould, Yonkers; Frederick W. Watkins, Morris Dock and Edward Wegmann, Jr., Division Engineers; salary $2,400 each. Alfred A. Horne and Edward D. Johnston, Tarrytown; George B. Burbank, Sing Sing; Evelyn P. Roberts and James P. Carson, Croton Dam; Robert H. Moore and Royal Chapin, Tarrytown; Frederick H. Baldwin and Thomas D. Whistler, Dobbs Ferry; S. Fisher Morris and Preston K. Yates, Yonkers; Walter McCulloh, Morris Dock; William B. Swan, Jerome Park, and William R. Warfield, 269 W. 125th street, Assistant Engineers; salary $1,800 each. Robert Ridgway, Sing Sing; William S. Humbert, Judd A. Lockwood, C. K. Gracie, Solomon Davis, Henry W. Bowly, Tarrytown; J. M. Stewart, Dobbs Ferry; Curtiss Millard, David B. Lewis, Yonkers; George R. Olney, Morris Dock; A. C. Chenoweth, 269 W. 125th street, Transitmen; salary, $1,500 each. Alfred H. Renshaw, Tarrytown; H. R. Wheeler, Sing Sing; F. B. Rogers, Croton Dam; G. H. Cunningham, Beverly R. Value, Tarrytown; Frank N. Speyer, Dobbs Ferry; Carlos F. Ferrer, Morris Dock, and H. N. Hamilton, 269 W. 125th street, Levelers; salary, $1,200 each.

The Severn Tunnel.

This tunnel commenced in 1873, was opened to traffic on the 9th of January last by a coal train of 14 cars.

The tunnel was projected to save the long detour by Gloucester, about 50 miles, encountered by the traffic between the Welsh coal mines and the south and south-west of England. The entire length of the tunnel and approaches is between 7 and 8 miles, of which 4½ are tunnel, about 2½ miles being under the estuary of the Severn. The cost of the tunnel and approaches has been about £1½ millions, which, with double tracks and changes in lines completed and contemplated, will bring the total cost of the improvement to about £2 millions. Mr. Charles Richardson has been engineer from the commencement, and since the tunnel was flooded in 1879, Sir John Hawkshaw has been associated with him.

ENGINEERING NEWS, Three Months, One Dollar and Fifty Cents.

PERSONAL.

MR. C. H. MYERS has been removed from the position of Assistant to the Engineer in charge of sewers, without warning, after a continuous faithful service of over twenty years.

He entered upon the work under the late Alfred W. Craven, Commissioner and Chief Engineer of the old Croton Aqueduct Department, and with Mr. Theodore Weston, the first engineer in charge of sewers when preliminary steps were taken to secure for this city a comprehensive system of sewers. MR. MYERS performed the field work in connection therewith.

Subsequently under Mr. Stevenson Towle, Engineer in Charge of Sewers, he served through all the various changes of administration to the present time, aiding in and being intimately acquainted with every step in building up the sewer system, and working his way through every grade up to that of First Assistant Engineer of the Sewer Bureau.

His perfect familiarity with everything connected with the sewers of the city ought to have secured him in the position he so long filled.

THOMAS LEIGHTON, a prominent bridge builder, died at his residence on East avenue, Rochester, on the 3d., aged 68 years. He built all the bridges for the New York Central R.R. four-track system, many on the Erie, Chicago and Northwestern, Illinois Central, and other Western roads, and also the immense bridges over the Connecticut river at Springfield and the one at Albany over the Hudson river.

AS MR. A. A. ROBINSON recently elected Second Vice-President of the Atchison, Topeka & Santa Fe Railroad Co., will, on and after February 1st, give attention chiefly to the Construction Department, the duties of General Manager will, on and after that date, be performed by the First Vice-President.

Mr. D. L. CHASE is appointed Superintendent of Transportation, in charge of the Train and Station Service, with headquarters in General Office building, Topeka, appointment taking effect February 1st, on and after which date Superintendent of Divisions will report to the Superintendent of Transportation all matters pertaining to the Train and Station Service. MR. CHASE, until further notice, will also continue to perform the duties of Superintendent of the Eastern Division. C. W. SMITH, First Vice-President.

The following changes in the changes and duties of the officers of the Corps of Engineers have been ordered:

L'eut.Col. Cyrus B. Comstock is relieved from duty in New York city, and will relieve Lieutenant Colonel H L. Abbott, of the command and duties at Willet's Point, N. Y. Lieutenant Colonel Abbott will take station at New York city, as a member of the board of engineers. Lieutenant Colonel Walter McFarland will relieve Major George L. Gillespie of his present duties and report to Colonel James C. Duane as a member of the board of engineers. Major Gillespie will take station at Boston, Mass., relieving Major Charles W. Raymond. Major Raymond will proceed to New Orleans and relieve Major Amos Stickney. Major Stickney will proceed to Milwaukee, Wis., relieving Lieutenant Colonel John W. Barlow; Lieutenant Colonel Barlow will proceed to Chattanoga, Tenn., and relieve Major Wm. R. King; Major King will proceed to Willett s Point and report to Lieutenant Colonel Comstock for duty to command the Battalion of Engineers; Captain James F. Gregory is relieved from duties in this city and will prodeed to Baltimore, Md., and relieve Major J. A. Smith, reporting for duty as engineer of the Fifth Light House District; Major Smith will proceed to Portland, Md., and relieve Colonel Charles E. Blunt; Colonel Blunt will assume the duties of supervising engineer of the district in charge of Majors J. A. Smith, Lewis C. Overman and Milton B. Adams and Captain Edward Maguire; Lieutenant Colonel David C. Houston is relieved from his present duties and will take station in New York city, relieving Lieutenant Colonel Walter McFarland of such work as the chief Engineers shall indicate, and reporting to Colonel James C. Duane, as a member of the board of engineers.

American Society of Civil Engineers.

The society met at their house on Wednesday evening, Feb. 3, about 40 members present, Vice-President Thomas F. Rowland in the chair.

Theodore H. McKenzie read a paper on the "Water Works of Southington, Conn.," which was discussed by the members at some length. Mr. S. S. Haight made some remarks on rapid multiplication, and illustrated his theory by blackboard examples. He was followed by remarks on a similar subject by Mr. Rowland and Secretary Bogart. The usual collation followed.

The following members and associates were declared elected:

For MEMBERS.—Edward William Eckert, (Rens. Pol. 1875.) Engineer of the Massillon Bridge Co., Massillon, Ohio; James Ellison Mills, (Sci. School, Harvard, 1857,) Consulting Geologist, Metallurgist and Mining Engineer, Quincy, Cal.; Edward Thomas Wright, Civil Engineer, Los Angeles, Cal.

FOR ASSOCIATES.—George Lord Burrows, President Niagara Falls International Bridge Co., Banker and Lumber Merchant, Saginaw, Mich.; Palmer Chamberlaine Ricketts, (Rens. Pol. 1875), Professor of Rational and Technical Mechanics, Rensselaer Polytechnic Institute, Troy, N. Y.

Engineers' Club of Philadelphia.

RECORD OF REGULAR MEETING, JANUARY 16, 1886.

President Washington Jones in the chair; 24 members present.

Mr. Howard Constable gave an interesting account of the system used in London for the Public Supply of Hydraulic Power, which he recently had occasion to examine. The company in London was started in 1882, based upon the success achieved by a similar scheme in Hull, which has been in operation some eight years; it in turn was the outgrowth of a system which prevails very extensively in many English manufacturing and warehouse concerns,—that of employing hydraulic cranes, hoist-capstans and the like, and operating them from one pumping station. This plan was advocated by Mr. Bramah as early as 1802, and during the past forty years Sir William Armstrong has done much towards putting it into practice by the manufacture of hydraulic plant, so that the advantages of the principle are much more thoroughly understood abroad, than with us. The general mind in this country looks with some fear upon high pressures and thinks the system rather novel, not knowing that our practice in the pumping of oil to the seaboard, pressing cotton and extracting oil from seeds, we employ hydraulic pressures ranging all the way from 400 to 5000 lbs., and over, per square inch, whereas the London Supply Co. use only 700 to 800 lbs.

Their plant consists of about 12 miles of cast-iron mains distributed throughout the busiest parts of London, on both sides of the river, and as far west as Victoria Station. The mains and branches are laid so as to avoid any dead-ends, and with stop valves so that any length of 1,000 feet can be isolated. The water used is taken from the Thames and filtered into tanks, from which it is received by the pumps and passed into two accumulators, thence on through the mains. The pumps are of the vertical three cylinder fly-wheel type, compound condensing, single acting plungers, directly connected to piston-rod. The starting and stopping of the pumps is done automatically by the accumulators: and in connection with this, the arrangement for letting live steam into the low-pressure cylinder is very ingenious. The boilers are of the Lancashire type, fitted out with automatic fuel hoppers, stokers, etc., and fuel elevator. The charges for power water are made upon meter register and a sliding scale of prices. The financial success of the company was almost assured from the first.

Some members discussed various points with Mr. Constable, among others an improvement in the cast-iron mains which had been made by Mr. Ellington, the Engineer of the London Co., and had increased the strength of the pipe about fifty per cent.

Mr. Constable also described a novel Rubber Spring for tram-cars, railway draw-bars, buffers and the like.

It consists of a cylindrical piece of rubber with a hole through the axis, and capped at both ends with bearing-plates; the draw-bar or location-bolt, of course, passes through the bearing-plates and rubber-spring. The peculiar feature is that a steel spring encircles the rubber, so that as the rubber is compressed it is re-enforced by an increasing resistance on the part of the steel spring, which tends to hug it back to its original form. It presents some excellent features for long range, endurance, uniformity or gradation of resistance, freedom from danger in collapse as well as in economy. They are being extensively used in England, and one that has been under test by the Chief Engineer of the North Eastern Railway has withstood up to the present time over 1,000,000 depressions of five tons. A model was shown, and it should be noted that the steel ring is not solid but laps over itself, so that the ends slide over each other as the rubber presses the spring outward; also that the section of the spring can be U. W. or other shape.

Prof. L. M. Haupt read a profusely illustrated paper on Harbors, containing data as to depths, etc., and showing that from New York to the Gulf there were only four natural entrances where the depth at mean low water was over 16 feet, while the largest ships draw from 26 to 28½ feet. He discussed the relation of the forces, stated the general principles to be observed in harbor improvements, commented on the unfavorable results obtained by using submerged jetties, and the reasons therefore, and called attention to a few special cases, which were reserved for a more complete discussion subsequently.

A model was also shown, exhibiting a portion of the bed of the lower bay of New York entrance, with the peculiar hole at the head of Gedney's Channel, with an explanation of the forces which had maintained it for many years. He also stated that he believed it entirely feasible to so modify the forces, as to change the direction of the resultant and throw it into Gedney's Channel. By such a local treatment an excellent entrance could be obtained to the harbor, at a cost very much less than that proposed to be expended for the submerged dykes—five miles long—and other works, estimated at five to six millions. The various features were freely illustrated by U. S. C. & G. S. and other diagrams.

Messrs. Coleman Sellers, Jr., Chn., Wilfred Lewis and M. R. Muckle, Jr., were appointed a committee to prepare a Memorial of the late Thedore Bergner.

HOWARD MURPHY,
Secretary and Treasurer.

CORRESPONDENCE.

Fast Telegraphing.

SCHOOL OF PRACTICAL SCIENCE,
TORONTO, CANADA, Jan. 29, 1886.

EDITOR ENGINEERING NEWS: There appeared in the ENGINEERING NEWS of January 9th 1886, an article in the Correspondence column headed "Fast Telegraphing," and in it the writer argues that, since the sun travels over 15 degrees of arc in one hour, and since the distance from London to New York or from New York to San Francisco is about 3,000 miles, therefore the difference of time between either of these places is about three hours.

This reasoning is fallacious, from the simple fact that the difference in time between two places does not depend on their *absolute distance* apart, but on their *difference of longitude*; that is on the distance apart of their two meridians of these places respectively which

is usually expressed in degrees, minutes and seconds.

Now the longitude of New York west of Greenwich is about 74 degrees, and of San Francisco nearly 122 degrees; and since the sun moves through 15 degrees of longitude in one hour, we have for New York $\frac{74}{15}$ = 4hrs. 56 min. slow of Greenwich time. San Francisco $\frac{122}{15}$ = 8 hrs. 56 min. Greenwich time Difference between New York time and San Francisco 8 hours 8minutes—4 hours 56 minutes = 3 hrs. 12 min. These quantities are of course only *approximate*.

Yours truly,

E. W. STERN.

Indiana News.

Special Correspondence ENGINEERING NEWS.

CHAMPAIGN, ILLS., Feb. 1886.

There is a probability that a fine opera house will be built in Brazil the coming season.

The trustees of the town of Salem have contracted with Moses Shrum to construct water works. The works are to be completed June 15, 1886; price $14,475.

The eagle, which is to be one of the figures in the allegorical groups on the front of the new State House, and which has just been finished by the stonecutters, was cut out of a block of oolitic limestone, from Bedford, 10 feet long, 5½ feet high, and 3 feet thick; the spread of the bird's wings is over 8 feet. The Commissioners expect to have the south half of the building, and the Representatives Hall and the Senate Chamber ready for occupancy next winter.

R. J. Smith will construct a horse railway from Terre Haute to Macksville and on to the Illinois State line. The road is to be used for hauling coal.

The Vandalia road will open a gravel pit north of Crawfordsville as soon as weather permits, from which large quantities of gravel will be taken with which to improve the road-bed.

Bullock and Murces have let the sub-contracts for the Vincennes water works, and the work will be pushed immediately. An eastern firm will build the iron stand-pipe; the stone and brick masonry, and pile work were let to local contractors.

Terre Haute inaugurated an electric light plant of 167 lights last week.

The new E. and I. road will construct a branch, from Riley to a point in Sullivan county on the E. and T. H., for the purpose of opening up the coal fields of Sullivan and Greene counties.

New gas works have recently been authorized in Greencastle, which proposes to supply gas at not to exceed $2 per thousand.

The natural gas fever has somewhat abated in Indiana; the results from numerous borings made in the last few month, are not encouraging. Small quantities have been found in nearly all parts of the state, the most being found in Cass, Newton, White, Jasper, and that tier of counties. In nearly all of the wells the gas is found at comparatively shallow depths, say about 100 feet or less, and is undoubtedly due to the decomposition of organic matter in the drift. The wells flow but for a short time, and seem to be shut off by mud and water. A few artesian wells having given a small supply of gas, the theory gained currency that gas in large quantities would be found under he Devonian shale, at about 2,000 feet deep. The theory was strengthened by the fact that De Pauw, at the New Albany Glass Works, had a well which produces enough gas to run an engine, and that just across the river, in Kentucky, there was a well which furnishes enough to heat a house, and evaporate twenty barrels of salt per day. Large quantities of gas into the Ohio river from this region.

It is now pretty generally conceded by both prospectors and locally eminent geologists that gas in paying quantities will not be found in Indiana, and certainly not except several wells be sunk close together and hooded, and then only by tapping pockets of gas in the drift.

De Pauw, of the New Albany Glass Works, has thoroughly tested the matter at that place, where the indications were the best of any in the State, and given it up; he has recently made an extended tour of the Pittsburg gas fields with the generally supposed object of looking for a place to locate his glass works. In this connection, mention may be made of the fact that Crane Bros, of Chicago, are seriously contemplating the removal of their pipe mill to the Pittsburg natural gas district.

Illinois News.

Special Correspondence ENGINEERING NEWS.

CHAMPAIGN, ILLS., Feb. 24th.

The commissioners of the Illinois' Soldier's Home have decided upon the cottage system; the cottages are to be two stories high, and capable of accomodating 24 inmates. Major S. M. Randolph, of Chicago, was appointed architect, and E. C. Nichols, of Kansas City, civil engineer.

The citizens of Decatur are protesting against the use of towers in the extension of their electric light system; they have tried the towers, and want hanging lamps instead.

Sibley, the Rochester, N. Y. seedsman, laid 116 miles of tile and constructed 30 miles of open ditch on his farm of 40,000 acres in Livingston county last year, at a cost of $78,000. He expects to lay about 2,000,000 feet of tile this year.

A street railway is proposed in Freeport.

Just now there is a great deal of inquiry by the citizens and officers of small cities as to the cost of lighting the streets, and the following data may be interesting: Bloomington is paying about $120 per lamp (Thompson-Houston system) for 160 lights, which number is soon to be increased to 175; Peoria pays $125 per lamp (Thompson-Houton system) for 140 lights; Quincy $125 for 135 lights (same system); Danville $124 for 49 lights. Champaign is now paying $1,627 a year for 84 gas posts, which includes repairs, or $20 per post. An electric light company has just offered to furnish 28 arc lights for $1,500 per year, and claim that they will light the city better that the 84 gas lights now do, with the advantage then or cloudy "moonlit nights, a telephone message would cause all the street lights to flame up at once. The rate offered Champaign ($53.50) is much less than any we have seen, and is probably accounted for by the fact that the same company owns the water works, and, having their engineers under salary, can do the work for less than could a company formed for that purpose. Lincoln has just made a new contract for ten years at $25 each for 150 gas post, which is a redution of $5 from the previous contract.

A number of the officials of the Chicago, Milwaukee & St. Paul road were in LaSalle last week, looking over the ground with a view of extending the road to that place.

Galesburg is discussing the advisability of building new water works, the present ones being considered practically useless.

The following data collected by the mayor of Galesburg will be interesting for comparison, especially in connection with the series of articles on Municipal Engineering appearing in another column.

Name of City.	Salary of Mayor.	No. Policemen.	Cost Fire Dept.	Cost Water per Year.	Cost Lighting Streets per Year.	Assessed Valuation of Real and Personal Property.
Quincy	$1,000	26	$17,000.00	$10,000.00	$17,000.00	$5,500,000
Champaign	900	2	1,000.00	3,750.00	.....	1,366,361
Elgin	300	5	1,363.80	.....	7,929.74	2,371,505
Galena	100	3	1,000.00	.....	850.00	600,000
Danville	600	7	.....	7,687.50	5,900.00	1,800,000
Cairo	1,000	7	1,600.00	6,000.00	3,600.00	.....
Altamount	300	3	3,000.00	.....	3,000.00	980,350
Joliet	300	9	4,300.00	9,000.00	4,6 0.00	1,945,994
Evanston	500	14	10,450.00	.....	6,596.10	3,000,000
Aurora	.....	8	2,500.00	12,000.00	.....	.....
Lincoln	.....	5	8,000.00	10,000.00	8,300.00	2,761,696
Bloomington	.....	4	.....	3,000.00	3,700.00	1,000,000
Rockford	500	17	7,000.00	7,700.00	15,000.00	3,500,000
Peru	600	8	6,800.00	11,163.00	9,600.00	4,343,942
East St. Louis	200	8	1,000.00	.....	1,000.00	500,000
Galesburg	1,000	20	.....	10,000.00	6,000.00	4,000,000
	300	7	5,500.00	.....	4,654.41	5,500,000

Quincy, Elgin and Anrora have elaborate systems of electric street lighting. The water works of Danville, Champaign, Quincy, Joliet, Alton and Cairo are owned by private companies, while Evanston, Aurora, Bloomington, Rockford and East St. Louis control their own works. The water works of Aurora cost the city $150,000; those of Bloomington, $125,000; those of Rockford, $419,533, those of East St. Louis $350,000, and Galesburg $10,000.

Arkansas News.

LITTLE ROCK, Jan. 26th, 1886.

Special Correspondence ENGINEERING NEWS.

Articles of association were filed January 23, in the office of the Secretary of State of the Little Rock and Hot Springs Railway. The capital stock is $1,000,000 of which 5 per cent. has been paid in. The officers are Mr. Jos. Raynolds, J. U. Conger, C. N., Rockafellow and M. N. Pierce, of Hot Springs, and J. M. Mone, of Little Rock. These gentlemen are also the officers of the Hot Springs Railway. The line as contemplated will run through Garland and Saleico counties, a distance of fifty miles to Little Rock.

The St. Louis and San Francisco R. R. Co. have a party in the field making a survey from Fort Smith north via Hackett City, and as soon as their new bridge over the Arkansas river at Van Buren is completed, which will be in about two or three weeks, it is expected that they will begin work in the southern extension.

The Home Water Works Co., of this city, have contracted for their new pumping engines, and will shortly commence the construction of their settling reservoirs. The reservoirs are to be situated at a distance of half a mile from the Arkansas river and a height of 250 feet above it. As soon as they are completed, the system of water mains in the city will be increased to nearly double the territory that they now cover.

The Arkansas *Gazette* has a "special" of January 26th from Augusta, Ark., referring to the certainty of building the Bald Knob branch of the Iron Mountain Railroad to that place. The locating survey strikes White river ten and a half miles from Bald Knob and about one and a quarter miles southwest of Augusta. The draw of the bridge is to be 225 feet and 52 feet above the river bed at its channel. The Union Bridge Co., of New York, and other companies have been examining the site preparatory to bidding. Proposals are to be opened on February 2d. The bridge will cost about $200,000. The distance from Bald Knob to Memphis is 85 miles.

I am also credibly informed that arrangements have been completed for the immediate commencement of the first 12-mile section of the Ultima, Thule, Arkadelphia and Monticello Railway. This road is projected to run from Ultima, Thule in Sevier county in the western part of this State, via Arkadelphia on the St. L., I. M. and S. Railway to Monticello, where it will connect with the L., R. W. R. and T. Railway and the system of roads east of the Mississippi. F.

Pacific Coast News.

SAN FRANCISCO, January 23, 1886.

Special Correspondence Engineering News.

The Southern Pacific R. R. Co. has decided to discontinue free passes between San Francisco and Oakland and Alameda, heretofore granted to employés of other railroads.

The Northern Pacific R. R. is enlarging its shipping wharves at Tacoma to secure better facilities for handling tea and wheat arriving by sea.

The Market Street Cable Company of San Francisco has commenced work on their fourth branch line along Hayes street. The road will be built according to the plans of the Market street line, with the one exception, that the foundation-piers, made of concrete, and on which the tube frames rest, are made every 12 feet instead of 9 feet. The piers are 5 feet wide, 14 inches thick, and are laid 10 feet below the street grade. After the Hayes street road is completed, there will be 4 cable lines terminating at the Golden Gate Park, within five blocks of each other: Geary and McAllister, on Fulton street, and the Hayes and Haight street lines.

Satisfactory progress is now being made in the construction of the California & Oregon R. R. north from Delta, Shasta county, California, to Ashland, in Oregon. About 1,000 men are employed. The "missing link" between the present terminus of the California & Oregon and the Oregon and California Road, is about 120 miles long. The line runs through very mountainous country. Mr. Hood, the chief engineer of the Southern Pacific Company, reports that the cost of bridges and masonry in the first 20 miles above the present terminus will not fall below $200 000. If the company is to build the road in two years, a force of over 4,000 men will be required, besides those employed in tunneling and bridging. The last forty miles below Delta, built two years ago, embraces 7 tunnels, the length being 1,800 feet long, and their aggregate length being about 1 mile. 10 more tunnels will be necessary in the extension to Ashland. The survey has recently been completed through Shasta and Siskiyou counties; the line passes Dogtown, Strawberry Valley, Fort Jones and Yreka.

California petroleum deposits, which have been largely developed during the last few years, are now attracting considerable attention in the East. Cap. Wallace Moore, of Pittsburg, Pa., an old operator in petroleum, who recently visited this State, speaks of our oil-industry as follows: "I visited the California oil-fields while away. The operators have got hold of valuable territory. In the Coast Orange mountains, it covers an area of 200 miles. It costs twice as much to sink a well 1,000 feet deep, as it does in Pennsylvania, but a 50-bar-

rel well in California is worth five times as much as a well of the same capacity in Pennsylvania.

The yield of California wells is gradually increasing, as shown by these figures: 1879, 13,543 barrels; 1880, 40,552; 1881, 94,162; 1882, 128,636; 1883, 142,857, and 1884, 262,000 barrels. The statistics of 1885 have not yet been completed.

The Columbus Mining District, in Esmeralda county, State of Nevada, is at present the largest mining district on the Pacific coast. The ore produced is, on an average, very rich, some mines assaying $45 to $50 a ton. In most of the mines, enough gold is found in the silver quartz to pay the expenses of taking out and reduction. Candelaria is the main camp of this district, located along the Carson and Colorado R. R. (narrow gauge); it has now a population of 1,500 inhabitants. 3,000 claims are worked at present in this district. They are rich in silver ore, but the prospectors have not been able to develop their claims, largely on account of the lack of milling facilities. An English company, the Candelaria Water Works and Milling Company, Col. W. J. Sutherland, of London, being general manager and J. E. Gignour, of Nevada, being resident superintendent, became possessed of the water interests of that district, and have recently commenced to erect a large mill for the reduction of ore, which will be ready for work about March 1st. The building is completed; the crushers will be in place by the middle of February. Smelters and other kind of machinery will be erected, so that the company will be able to reduce all kinds of ore. The capacity of the mill will be at first about 100 tons of ore a day; it will be increased as the development of mines demands. The company was organized in January, 1884, and commenced the erection of their mill in October last. The capital stock is £200,000, divided into 200,000 shares of £1 each, all of which were taken at the first call. The directors are Lord Devon and Messrs. Growe, Hultz, Kekovich, Cullysands and Bear; the headquarters of the company are in London. Mr. Sutherland will be manager, with his office in San Francisco. The White Mountains, about 23 miles from Candelaria, furnish the water; 28 miles of pipe have been laid, the necessary right of way has been secured, and sufficient water is in reserve, that the mines will need for some time. Complete connections with the camp will be made as soon as the frost is off the ground. One of the principal objects of the company will be to advance money to prospectors on the product of their claims.

A short time ago a corporation was organized in Walla Walla, Washington Territory, under the name of "The Farmer's Railway and Steamboat Portage Company." The principal object of the company is to build a road around the Dalles, over which steamboats and other craft can be transported around the rapids. The nominal capital of the company is $1,000,000 divided into 10,000 shares of $100 each. Two other parties claim the previous right to build this road, one is the Oregon Railway and Navigation Company and the other is Harry McCartney, a civil engineer, with D. O. Mills to back him. Thus it appears that three companies, two of them backed by great wealth and resources and one a home-organization, are contesting for the business of handling laden steamers and other craft around the chief obstruction to the navigation of the Columbia river; the intention is to get the road in operation on or before the completion of the canal and locks at the Cascades. One part of the scheme is, to urge upon Congress the pressing necessity for the speedy completion of the Cascades locks.

The big income the Oregon Railway and Navigation Company receives from transportation of freight to and from the inland is evidently attracting the attention of men having money to invest in paying enterprises.

The Portland and Willamette railroad (Oregon) began active operation on January 14th, 1886. The line runs from Portland to Townsend, where the east and west side divisions of the gauge systems unite. It is in fact a completion of these lines to Portland, though it is built by another company. The rails have been ordered in Philadelphia and will be sent by sailing vessels. The temporary terminus will be near Red-House in South Portland, where the company has large interests in property and a good water front. It is expected that the road will be completed by the middle of July. The cost is estimated at $700,000.

G. J. S.

WATER

HEMPSTEAD, Texas, is discussing the building of water works.

SHERMAN, Texas, will probably build water works. Plans will be received.

ELGIN, Ills., is getting nearer to actual water works construction.

THE new stand pipe at Abingdon, Mass., will be 125 feet high, and will contain 2,000 tons of water.

A SPECIAL borough meeting at Danbury, Conn., has voted in favor of issuing $100,000 of water bonds.

GODERICH, Ont., proposes to build water works.

THE franchise for building water works at Streator, Ill., was awarded last week to the firm of Bronson & Foster, of New York.

WINTHROP, Mass., is to have a sewerage system. Summer residents have complained, and sewers are now necessary to keep up the reputation of the town.

THE Standard Oil Company is to furnish Salamanca, N. Y., with natural gas for lights and fuel. A pipe line is to be laid from the Kane, Pa., oil field where the gas will be secured. The line is now being surveyed. The estimated cost will be $140,000.

THE people of Santa Rosa, Cal., have been boasting of their artesian well, which reached but forty feet into the earth, but its abundant flow now proves to be derived from the reservoir of the local water company. The well will be corked up.

TENDERS are invited for the supply of cast-iron mains, castings, and other ironwork, for the Tansa water supply project, for the Municipal Commissioner for the city of Bombay. Copies of instructions, form of tender, and specification can be obtained at the office of the Municipal Commissioner in Bombay, and at the office of Messrs. E. W. and R. Oliver, solicitors, 1 Corbet Court, Gracechurch street, London, E. C. Tenders to be sent to the Municipal Commissioners, by 18th March.

MR. JOHN PENNIE in a pamphlet attacks the Andrews driven-well system for the water supply of Albany, N. Y., and suggests a supply from Lake George as a substitute. As he describes it, Lake George is 60 miles from Albany, and has a water surface 243 feet above tide. The water can be conducted to Albany and Troy by the Champlain canal, which is owned by the State, and by a system of wrought-iron pipes such as are used for the water supply of San Francisco.

JOHN W. ALVORD, engineer for the town of Lake View, Cook county, Ills., writes us: "Noticing in your issue of Jan. 23 an item on the Lake View water famine, I would like to correct the impression there formed by stating that our supply was cut off for a few hours only on Jan. 9th owing to the formation of Anchor ice on the crib, a contingency to which all our lake towns are liable. A report just made upon an analysis of our water by G. A. Mariner & Co., Chemists, of Chicago, states that it is uncontaminated and will compare favorably with any water supply in the country."

CORPORATION Counsel Taylor has taken necessary steps to appeal from the verdict in the suit of Jacob Van Wyckien against the city of Brooklyn. Mr. Van Wyckien sued for $30,000 damages to his property in consequence of the water of Spring creek alleged to have been diverted by the construction of the city's pumping stations. The plaintiff recovered $7,500. Mr. Taylor believes that the law points are so close that there is a good prospect of a reversal.

MANCHESTER, ENGLAND, WATER WORKS.—For the improvement of its water system, Manchester is about spending $15,000,000, which is in addition to its present works, costing $20,000,000. Five lines of pipe, forty inches in diameter, will be laid from Lake Thirlmere, a distance of one hundred and two miles, carrying the water by gravitation, the capacity of each pipe being nearly ten million gallons a day. The first contract for about seven miles of tunnels, mostly through rock, has been let at $625,000 to the lowest of twenty-one bidders. It is estimated that the cast-iron pipe for the first line will cost $1,250,000.

THE PUMP THAT COST $1,000,000.—The largest pumping engine in the world is that at Friedensville, Pa., used to pump water out of a zinc mine. It was built at Merrick's foundry, Philadelphia, in 1870, at a cost of nearly $1,000,000. Its parts were so heavy that all the bridges along the line of the North Pennsylvania Railroad, from Philadelphia to Center Valley, were strengthened to insure against accident. Its cylinder has a diameter of 110 inches; the piston rod is fourteen inches in diameter. It has a stroke of twelve feet, and in one minute forces over 20,000 gallons of water, or 30,000,000 gallons daily, out of the mine to a height of 130 feet.

ALBANY, Jan., 31.—The following is from the unpublished part of a report by the State Board of Health relative to drainage in Canandaigua:

"A water supply from Canandaigua village is just being introduced. With the free use of water which will soon begin, the want of a thorough plan for sanitary sewerage and drainage will be very much felt. If sewerage and drainage are neglected, after the water supply has been introduced, the health of the village will undoubtedly suffer. We, therefore, recommend that in considering the disposal of the brewery sewage and the purification of Sucker brook, these meetings may be made simply a part of a general consideration of a complete and approved plan for the sanitary drainage of Canandaigua."

A LARGE force of men is engaged in digging a new well for the Homer, N. Y., water works, just west of the present series of gang wells at the pump house. It will be twenty feet across, twenty-five feet deep, and iron-curbed. About two-thirds of the work is completed. With this well it is thought sufficient water may be had the year round.

OGDENSBURG, Jan. 30.—Morris, Kellogg & Morris, attorneys of this city, have brought an action in behalf of Mrs. Jennie Morris, whose husband, Robert E. Morris, died on September 25, from injuries received while in the employ of the aqueduct commission as civil engineer, against Brown, Howard & Co., contractors. The plaintiff's attorneys base their cause of action on the ground that Mr. Morris came to his death through negligence on the part of the contractors. Mr. Morris got upon a car to ride into the tunnel and the man in charge neglected to attach the cable. The car went down with great rapidity and came into collission with another car. Morris was thrown to the ground and sustained injuries from which he died on the following day. The action was brought in Westchester county and the plaintiff seeks to recover $5,000 damages.

TENDERS are required for the Hyderabad Sind Municipal Water Works: a steam pumping engine, complete (without pipes) with all the latest improvements regarding economy of consumption and maintenance, capable of delivering 85,000 gallons of water per hour easily, at a slow speed, on a total lift of 90 feet, or, say, depth of suction 20 feet, and height of delivery 70 feet. The steam engine to be worked by an existing loco-multitubular boiler, with 375 square feet of effective heating surface, and now doing the work as above described (with wood fuel) with a pressure of 50 pounds per square inch. Apply, sending plans, showing suction and delivery pipe, connections to pump, as also steam and exhaust pipe connections, with the respective diameters of each of their passages, and with price free on board, and insured, by British India Steam Navigation Company's steamer to Kurrachi, to the Collector and President, Hyderabad Municipality, Hyderabad Sind. Tenders will be received up to 28th February.

WHY THE PIPES BURST.—Since the occurrence of so many breakes of pipes while being tested, we have taken the trouble to ascertain what thickness of 16-inch pipe is used in the different cities of the United States, and we give below a list, accompanied by the highest pressure in pounds, to which such pipes are subjected:

Baltimore	13-16	in. thick—greatest press.		95 lbs.
Chicago	3-4	in. full—	" "	55 lbs.
Cleveland	3-4	"	" "	65 lbs.
Providence	3-4	"	" "	78 lbs.
Lowell	3-4	"	" "	87 lbs.
Rochester	1	"	" "	87 lbs.
Albany	7-8	"	" "	87 lbs.
Milwaukee	11-16	"	" "	87 lbs.
Fall River	1 1-8	"	" "	113 lbs.
Aurora	¾	"	" "	150 lbs.

Why does our engineer expect ¾ inch pipes in Aurora to stand so much higher pressure than they do elsewhere?—Aurora *Express*.

THE UNION LEAGUE CLUB AND THE QUAKER BRIDGE DAM.—The special committee of the Union League Club of New York, which was appointed to consider the advisability of constructing the proposed Quaker Bridge Dam, have just made a report to the Aqueduct Commission.

The committee, or rather its engineers, figure out that the ten possible reservoirs upon the four branches of the Croton river have a combined storage capacity of about 53,000 millions of gallons, while only 30,000 millions of gallons is estimated for on the completion of the new aqueduct. This stored water they estimate would furnish 300,000,000 gallons per day for six months.

They think the Muscoot river and the Sodom dams if constructed would furnish all the storage required for some years; and they recite the advantages of having separate reservoirs in time of threatened destruction by force, or in case of any contamination of some one reservoir.

The committee recommends therefore, that the Commission build first the Sodom dams with as large reservoirs as possible; that the other sites be carefully surveyed, and the dams built as the city needs them. The committee also recommend that the Aqueduct Commission further carefully consider the advisability of building the Quaker Bridge Dam, after all data concerning the practicability of storing water and the amount of such storage on the four branches of the Croton be ascertained. They suggest too that before any decision is made on the building of the Quaker Bridge Dam, the Commission employ not less than three "civil engineers of well known capacity, experience and judgment" to study the whole question of the Quaker Bridge Dam, and report individually; and they specifically state that these three engineers shall not be taken from among those who are in the employ of the Commission or have "heretofore given an opinion upon the necessity, advisability, or practicability of building the proposed Quaker Bridge Dam

Water Pressure in Mains of Various Cities.

COMPILED BY J. J. R. CROES, FROM SPECIAL RETURNS, JAN. 1886.

Town and State.	Topography.	Difference of level in town.	In Business District.		Fire Pressure.
			Day Pressure.	Night Pressure.	
		feet.	lbs.	lbs.	lbs.
Chelsea, Mass.	hilly.	6	44	47	44 to 47
Cheshire, Mass.	hilly.	20 to 50	110	120 to 130	110 to 130
Chicago, Ill.	level.	0	15 to 25	20 to 30	15 to 30
Chicopee, Mass.	undulating.	100	40 to 80	40 to 80	120
Chicopee Falls, Mass.	undulating.	50 to 100	70	70	150
Cincinnati, Ohio.	hilly.	390	35	40	——
Clarion, Pa.	hilly.	50	40	40	40
Clay Centre, Kan.	rolling.	50	45	45	160
Clearfield, Pa.	level.	0	75	85	75 to 85
Cleburne, Tex.	rolling.	20	30 to 40	30 to 40	200
Cleveland, Ohio.	sloping.	0	20 to 55	26 to 62	20 to 62
Clinton, Ia.	nearly level.	——	45	50	——
Clinton, Mass.	hilly.	1 to 70	100	100	100
Clinton, N. Y.	sloping.	27 to 50	——	——	——
Clyde, Ohio.	level.	0	40	40	150
Cohoes, N. Y.	hilly.	60 to 155	55	60	60
Colorado Spr'gs, Col.	level.	75	80	80	80
Columbia, Tenn.	rolling.	20 to 30	90	90	80 to 100
Columbus, Ind.	level.	——	40	40	80
Concord, N. H.	——	60 to 85	46	50	46 to 50
Connellsville, Pa.	hilly.	75	90 to 140	——	——
Constantine, Mich.	level.	0	30	30	60 to 160
Corning, N. Y.	hilly.	150	90	90	90
Cortland, N. Y.	mostly level.	——	67	74	——
Covington, Ky.	hilly.	10 to 20	20 to 30	25 to 35	40 to 60

POUGHKEEPSIE, Jan. 21.—About a week ago a representative of the Attorney-General made application to Judge Barnard for an order directing the Board of Supervisors of Westchester county to obey Governor Hill's order to extend the sewerage system of Mt. Vernon. Judge Barnard has decided that the supervisors are not county officials within the meaning of the law, and hence has denied the motion. The case will go to the General Term.

CLEANING WATER PIPES.—The annoyance arising from the stoppage of waste pipes in country houses, although very great, is but a small matter compared with the dangers which may follow obstructed pipes. The "sewer gas," about which so much has been written and which is so justly dreaded, is not, as many suppose, the exclusive product of the sewer. Indeed, the foulest, most dangerous and deadly gases are not found in the sewers themselves, but in the unventilated waste pipes and those which are in process of being clogged by the foul matter passing through them. Any obstructions in the soil or waste pipes are therefore doubly dangerous because it may produce an inflow of foul gas into the pipe, even though the entrance to the sewer itself has been entirely cut off.

The question is how to get rid of the accumulations in pipes partly stopped or already closed. Digging up and cleaning out is a costly remedy, often ineffectual by reason of careless workmen. The second is the plumber's force pump, which is usually only a temporary relief. In pipes leading from the house to the cesspool there is a constant accumulation of grease This enters as a liquid and hardens as the water cools and is deposited on the bottom and sides of the pipes. As these accumulations increase, the waterway is gradually contracted till the pipe is closed. When the pipe is entirely stopped or allows the water to flow by drops only, proceed thus: Empty the pipe down to the trap, or as far as practicable, by "mopping up" with a cloth. If water flows very slowly, begin when the pipe has at last emptied itself. Fill the pipe up with potash, crowding it in with a stick. Then pour hot water upon it in a small stream, stopping as soon as the pipe appears to be filled. As the potash dissolves and disappears, add more water. At night a little heap of potash may be placed over the hole and water enough poured on so that a supply of strong lye will flow into the pipe during the night. Pipes that have been stopped for months may be cleaned out by this method, though it may call for three or four pounds of potash. The crudest kind, however, appears to act as well as the best. If the pipe is partially obstructed, a lump of crude potash should be placed where water will drip slowly upon it and so reach the pipe. It is also well to fill the upper part of the pipe with the potash as before, and allow hot water to trickle upon it.

Soda and potash are both used for the purpose of removing greasy obstructions, and the usual method of application is to form a strong lye and pour it into the pipe. It is better to put the potash into the pipe, because the water which it contains, instead of diluting, helps to form the lye. As water comes in contact with the potash it becomes hot, thus aiding in dissolving the grease. Potash, in combination with grease, forms a "soft" or liquid soap, which easily flows away, while the soda makes a hard soap, which, if not dissolved in water, would in itself obstruct the pipe. When a pipe is once fairly cleaned out, the potash should be used from time to time, in order to dissolve the greasy deposits as they form, and carry them forward to the cesspool or sewer. The potash is very valuable for this purpose, because, in addition to its grease solving powers, it is exceedingly destructive to all animal and most vegetable matters. The most dangerous and deadly gases appear to come from urinals and washbasin pipes, these, in many cases, seeming to be more foul than those from water-closets. The decay of the soap and animal matter washed from the skin appears to be the sources of the gases. The potash will be effective in keeping these pipes clear, and in this way may lessen the dangers.—*American Artisan.*

NEWS OF THE WEEK.

CONTRACTING.

There is no single class journal in the United States read by so many contractors for all kinds of Civil Engineering construction as ENGINEERING NEWS AND AMERICAN CONTRACT JOURNAL. *We propose as in the past to publish early intelligence of all new contract work. Our prices for advertising proposals for contracts is twenty cents per line, and it is so cheap that parties having any work to advertise will always find it a good investment to use this journal.*

Pumping Machinery.—Smith, Vaile & Co., of Dayton, O., have been awarded the contract for furnishing the pumping machinery for the water works of Minerva, Ohio, and Rockford, Ills.

Delaware Breakwater.—Bids will be opened in Washington on February 19th, furnishing about $23,000 worth of stone for use at the Delaware Breakwater. The last contract was performed by Andrews & Locke of Wilmington, Del.

The American Dredging Company has been awarded the contract for dredging and removing the excavated material from docks on the Delaware and Schuylkill river at Philadelphia during 1886, at 28 cents per cubic yard, measured in the scows.

A Frozen Water Pipe Suit.—BUFFALO, N. Y., January 26.—C. L. Sherrill & Co., printers and publishers, yesterday afternoon filed papers in an action against Collins & Joynes [Jesse H. Farwell], of Detroit, to recover $2,000 damages which they allege they have sustained by reason of the defendant's causing the plaintiff's water pipes to freeze while they were excavating for the sewer in Swan street during the winter of 1885. Sheriff Gilbert seized the machinery of the defendants to the value of $3,000.

Iron Roofs.—Bids for furnishing, delivering and erecting the wrought and cast-iron work for roofs of the west and center wings of the State, War and Navy buildings, were as follows:

Snead & Co., Iron Works, Louisville, Ky., $56,688. Haugh, Ketcham & Co., Indianapolis, $59,159.11. J. B. & J. M. Cornell, N. Y., $62,874. Bartlett, Hayward & Co., Baltimore, $67,923.72. Builders' Iron Foundry, Providence, R. I., $71,400. Phœnix Iron Company, Trenton, N. J., $75,585.50. Post & McCord, N. Y., $91,573.

Boilers.—At a meeting of the Wilmington, Del., Water Commissioners, the following proposals for furnishing a set of boilers, aggregating 400-horse power, for city mill pumping station, were received and read:

Samuel S. Adams, $10,500 or $9,800, according to location and arrangement, complete, with brick-work, steam-fitting and connections; William E. Kelley, Philadelphia, $6,970; Southwark Foundry and Machine Company, Philadelphia, $5,645; Babcock & Wilcox Co., New York, $7,468; Edge Moor Iron Co., 200-horse power, $3,820; Hilles & Jones, $5,752 and $6,220; Henry Warden, Philadelphia, $5,400; Hezekiah B. Smith Machine Co., Philadelphia, $6,200 and $6,550. The bids were referred for consideration.

Explosions on the New Aqueduct.—On February 3d, at 2.20 A. M. about 175 pounds of dynamite exploded at Shaft 22, near Fordham Heights, on the line of the New Aqueduct. The dynamite was being thawed out at the time of the accident. The result of the explosion was far reaching, the houses and railroad stations in the intermediate neighborhood were wrecked, and plaster thrown down, windows broken and gas and electric light put out for some miles around. Only one man was killed, the one in charge of the powder-house. There was another explosion on the same day at Shaft 18½ but little damage was done.

Grand River Bridge.—The award for building the Grand River Bridge at Grand Junction, Col., has been made to the Groton Iron Bridge Company for the sum of $32,893. The bridge is to be built on the Grand Junction side of the river, and the work will be commenced at once, as the bridge is to be completed by June 1.

The structure will be 710 feet long, consisting of four spans of iron truss, and a section of 160 feet in short spans, resting on iron piles driven to bed rock.

There were twenty-four bids for the bridge, three of which were for a combination bridge, the remainder were for iron. The bids ranged from $23,420 to $43,580. The plan selected by the State Board of Engineers is for a first-class iron bridge.

Street Paving.—The contracts for granite street paving at Cincinnati, O., have been awarded as follows:

F. H. Kirchner, concrete foundation; Front street, East, $21,322.75; Wood street, $12,367.24; south half of Fifth street, stone foundation, $2,352.55; Second street, with concrete foundation, $181,258.94.

John O'Brien, concrete foundation; Front street, West, $50,217.05; Hoadly street, $10,356.60; McMicken avenue, $57,194.19.

Folz and Ashman, concrete foundation; Central avenue, $206,877.01; Eighth, $114,713.02.

M. S. Forbes, limestone foundation; Vine street, $122,744.67; north half of Fifth, $6,244.20; Fourth street, $152,002.82; Fifth street, East, $34,287.13; Court street, $25,422.66.

The committee reported in favor of concrete foundations in some cases, and limestone in others; but stated they thought a uniform thickness of 10 inches of concrete unnecessary; they recommended an average thickness of six inches. The report further says, "The difference between the cost of the improvements with a 6-inch concrete foundation and the limestone is not great enough to justify awarding the contract for any foundation but the best. We call especial attention to the fact that on one of the largest and most central streets, viz., Central avenue, the difference between the bids for limestone and six inches of concrete will be only $213.53, as follows:

The bid for six inches concrete would be $185,521.30, while the bid for six inches limestone is $185,307.77."

Railroads, Bridges and Canals.

The Millcreek Valley R. R. has been incorporated to run from Ripley, W. Va., to connect the O. R. R. R. t the mouth of Millcreek. The line will be extended rom Ripley to Weston.

Norfolk and Western R. R.—The net earnings of 885 were $1,121,829 against $1,194,294 for 1884, or a decrease of 6 per cent. The proportion of expenses to gross earnings in 1885 was 60 per cent. against 56 per cent. in 1884.

The Leavenworth Northern & Southern Railroad will be built, $90,000 having been voted for it in Leavenworth county. The starting point is at Kansas City, running in a northwesterly direction to Pawnee City, Nebraska, thence on up the Loop valley into Montana.

The Troy Cable Motor Company has been organized to operate railroads on the Lighthall cable system. Trustees: Gilbert Robertson, Jr., Samuel Foster, Troy; Almerin H. Lighthall, New York; Delavan Peck, Chas. Angus, Albany.

Ohio Valley R. R.—The grading from Henderson to Morganfield, Ky., was completed on the 21st, and the track will be laid at once. The grading between Morganfield and Dekovan is in progress. The contractors insure the completion of the road between Henderson and Dekovan by the 1st of May.

An Inter-County Bridge.—A committee of the levy court has been viewing a site for a proposed bridge in Brandywine hundred, Delaware, on the State line. They will meet the commissioners of Delaware county, Pa., and take into consideration the construction of an inter-county bridge.

The Chicago and Indiana Coal Railroad graders have at length reached Brazil, Ind., working their way through frost and mud. The work of construction has been pushed right on in the face of unfavorable conditions. Progress is also making in track laying, which is now completed to Rosendale, fourteen miles north of Brazil. This is the only road now throwing dirt in Indiana.

The Wheeling Junction Railway Company has been formed for the propose of constructing a railroad from the south line of Twenty-first street, in the city of Wheeling, W. Va., by the most practicable route, to a connection with the Wheeling, Pittsburgh & Baltimore Railroad, in that city, about 800 feet west of the tunnel. The principal office or place of business is to be located in the city. Capital stock, $50,000.

A Bridge Deal.—A couple of county officials appeared in a lawyer's office a few days ago, and desired to retain him to come down to their section and assist the prosecuting attorney and board of supervisors in a little matter.

"What is the case?" he asked.

"Well, we voted $22,000 to build an iron bridge. The bridge didn't cost but $14,000, but we can't find where the other $8,000 went to."

"O! that's it. Well, I know. I got $2,000 of it for advising the contractor to skip with the rest. He's in Canada now."

Brooklyn Bridge Extension in New York.—The bill for the extension over Chatham and Center streets has been signed. The total length will be ninety-eight feet, from the end of the present station across to the curb on the Center street side of City Hall Park. The tracks, however, will not extend further than the Chatham street line, but this will give a total switching space of 166 feet, enough to transfer four long cars from track to track, or five short ones, while the present limit is two long cars or three short ones. The extension, therefore, practically doubles the capacity of the bridge, for a long train, with the facilities furnished by the extension, can be handled just as readily as a smaller one. The travel now averages 70,000 a day, and compasses the bridge capacity during the evening and morning hours, but with an ability to carry 140,000 people a day the crush will be done away with. The structure will be wholly of steel, and will be fifteen feet six inches high in the clear. It will not be covered, this being a concession made to Mr. Ottendorfer as the price for his consent to its erection. It will be built in two spans, that across Chatham street, bearing the tracks, being forty feet wide, and that over Center street, a simple footwalk, having a width of sixteen feet. The footwalk terminates in two pairs of stairways, each eight feet in width. Fifteen feet will have to be taken off the corner of the Elevated R. R. station, as the building must be moved back that far. The bridge has an order from the court compelling the road to move, but as the two are on friendly terms the more economical course is likely to be pursued and a sufficient section taken off to admit the passage of the new platform.

The Parsons and Pacific R. R. has filed a charter. The road will extend from Parsons, Kan., to Albuquerque, N. M., with a branch through the Indian Territory to El Paso, Texas. The officers of the road are: H. C. Mirick, Athens, O., President; C. H. Kimball, Parsons, Kan., Vice President; Lee Clark, of Parsons, Kan., Secretary and Treasurer.

The Bell's Gap Railroad extension is now under way with a large force of men. The road commences at Irvona, Pa., passing Gazzam, the present terminus of the Beech Creek Railroad, at a distance of two miles it crosses the summit between Witmur and Wilson runs, and follows Wilson run to Newburg and Chest creek to its mouth, a distance of fifteen miles.

The Great Eastern Railroad, Arkansas, goes through Flippin and Gassville to Mountain Home, in Baxter county; thence to Evening Shade, in Sharp county, and from thence to Hoxie, where it will cross the Iron Mountain R. R. and be built east to Cottonwood Point, on the Mississippi river. There is also talk in that part of the state of a railroad from Batesville through Marion County, and from Springfield, Mo., to Little Rock.

The Montana Central Railway Company organized January 27 by the election of the following board of officers:

President, Charles A. Broadwater; *Vice-President*, Benj. F. Potts; *Secretary and Treasurer*, Wm. Harrison; *Chief Engineer*, J. T. Dodge.

The company's office is located in Helena, Mont., in a handsome suite of rooms in the Montana National Bank building, where the engineer force have also their headquarters.

Celestials vs. Hoodlums.—J. A. Roberts, civil engineer, of this city, after an experience of three years on the Pacific Slope, volunteers a good word for the Chinese laborer. He says they are the best foreigners on the Pacific side of the continent; they are "peaceable, frugal and industrious, take good care of their own sick and disabled, and don't become politicians as soon as they land. They make better laborers and are more trusty than the hoodlum element which is prosecuting them."

The Wyandotte, Northwestern and Chicago Railway Company has filed its charter. The road will run from Kansas City to a point near Quindaro. The headquarters of the company are at Wyandotte, and the incorporators are V. J. Lane, D. E. Cornell, F. A. Mapes, A. D. Burrows, W. J. Buchanan, A. M. Ward and T. A. Scott, of Wyandotte; Wm. H. Miller and W. M. Talconer, Kansas City, Mo. The capital stock is $100,000. The road will make a connection with the new bridge across the river at the old town site of Quindaro.

Widening a Tunnel.—The tunnel one mile north of Pottsville, on the extension of the Pennsylvania Schuylkill Valley Railroad, has been under way for two months and was designed for a single track. Orders were received recently to widen it for a double track and to arch it with brick instead of timbering it. This will delay the opening of the new railroad to Mahanoy City until next fall or winter. The increased cost will be $40,000, making the whole cost of the tunnel about $150,000.

The Galt Railroad's extension to Montana is only a question of a few months. There is no doubt that the money will be forthcoming, as it lacks less than $20,000 of the $100,000 required. As soon as the preliminaries are settled, an effort will be made to have the work of construction commenced at both ends of the line, and the work pushed forward to completion without delay. It is expected the charter will be received from the Dominion Government by the middle of March

The Delaware, Lackawanna & Western Railroad Company has been for several years considering plans whereby it may reach western Pennsylvania and ultimately Chicago and St. Louis. Mr. Sloan, the President of the road, has lately been negotiating with the Buffalo, New York & Philadelphia R. R. for running arrangements to reach New Castle, Pa., and Pittsburg over the Pittsburgh & Western R. R. From New Castle he proposes to get into Chicago over the Chicago & Atlantic R. R., which is already built to Marion, O., and is preparing to build to New Castle, 100 miles off. It is said the new road will be pushed to completion this year, as Mr. Sloan is anxious to get into both Pittsburg and Chicago as soon as possible.

Morris County R. R.—A bill has been introduced which authorizes the Government, under proper restrictions, to grant the right of way across the grounds of the powder depot, near Dover, N. J., to the Morris County Railroad Company. This railway which is building to give transportation to iron ore mined on its line, will connect the New York, Susquehanna and Western R. R. on the east with the Delaware, Lackawanna and Western R. R. on the west. The connecting road will be ten miles long. The United States Government gave the right two or three years ago to the Central Railroad Company of New Jersey, but that company, being unwilling or unable to use it, has yielded and assigned all its rights in the grant to the Morris County Railroad Company, which now seeks the confirmation by Congress of the transfer.

Engineering on Horseback.—DALLAS, Tex., January 22.—B. S. Walthen, for many years locating engineer of the Gould system in Texas and Mexico, came in to-day from Greenville, having made the trip on horseback. It took him two and a half days to come thirty-seven miles. He goes to-night to Lenton, and will ride over the country thirty miles, from Denton to McKinney, with a view of spying out an extension of the East Line Railroad from McKinney west via Denton.

Michigan's Railroad Schemes.—The Marquette, Houghton & Ontonagon R. R., and the Mineral Range R. R. (narrow gauge) will be connected by a drawbridge over the arm of the Portage Lake The Chicago & Northwestern R. R. will build a branch to Gogebic iron range. The Milwaukee & Northern R. R. will build a branch to the Menominee range. The Milwaukee, Lake Shore & Western R. R. will push further into Ontonagon county. The Canada, La Crosse & Southwestern R. R. will be begun in the spring.

Cincinnati, Indianapolis, St. Louis and Chicago Railroad. The extension of the branch from Columbus to Greensburg, westward to St. Louis, is contemplated, and a corps of civil engineers has made a survey of the proposed line from Greensburg to Bedford, Ind., where it is proposed to connect with the Bedford and Bloomfield R. R. (n. g.), which runs from Bedford to Effingham, Ill. The project includes the purchase of this line, it being the intention to widen the gauge to standard width, and from Effingham construct a new line direct to St. Louis.

The Toledo, Saginaw & Muskegon Railroad Company has been incorporated for the construction of a road from Muskegon to Saginaw, intersecting the line of the T. A. A. & N. M. R. R. in Gratiot county. The Board of Directors is as follows: For Toledo, James M. Ashley, David Robinson, Jr., Wm. Baker and John Cummings, of Toledo; Lyman G. Mason, of Muskegon; A. W. Wright, of Saginaw. The work will be pushed without delay. That portion lying between Muskegon and the point of connection with the Toledo, Ann Arbor & North Michigan R. R. will be completed during the coming summer—about 100 miles. The balance to Saginaw, about 45 miles, will be built later, though it is possible that it may be completed the present year.

California & Oregon R. R.—A great effort is being made by the Southern Pacific R. R. Company to extend the California and Oregon to a junction with the line from Portland. There is now a large force of graders, bridge-builders and tunnel-diggers at work north of Delta, in all about 800 men. The work is of the heaviest character, and it is hardly any wonder, in view of the hard rock, deep cuts and long tunnels, that it has so often been abandoned. It would appear that the line is to be pushed through to Ashland, Oreg., the terminus of the Oregon & California R., R., as soon as practicable. The recent action of the Chamber of Commerce in recommending the non-forfeiture of the lapsed grant of the company is thought to be the main reason for the renewal of activity on the extension. Track has recently been laid as far as Slate Creek, about five miles above Delta.

Canadian Pacific Lawsuits.—A correspondent at Montreal writes to the St. Louis *Globe Democrat* as follows: "The Canadian Pacific Railway Company are just now experiencing the results of their very short-sighted policy in the construction of the line. These results have primarily taken the form of lawsuits, in which 'John M. Pinkerton' and 'I. S. Winston & Co.' and 'John A. McRae' are plaintiffs and the railway company are defendants, for large sums, balances due on construction work north of Lake Superior.

"The company pleads that the work is not properly done and that the extra charges are exorbitant. The contractors smile and say: 'All work, material and extras have been examined and passed by your own engineers, placed there during construction for the purpose of checking the work.' And they are right. The directors of the Canadian Pacific, although good financiers, and sharp enough to borrow money from the Government, know nothing about building a railway. They thought to save on the tremendous cost of building a line over such a country as that lying north of Lake Superior, by cutting down the paltry salaries of the men who were to see that the work was properly done. Messrs. Van Horne & Co. refused to pay any of their sub-engineers more than $75 or $100 per month.

"At such figures only very young graduates could be engaged, but the directors urged that they could watch as well as any one. These young men, on reaching the ground, found head cooks in the shanties earning $100 and $150 a month and a good 'drill man' on the blasting work getting $5 per day, while they, after four or five years' college training and practical work, were receiving smaller wages than these day laborers. How would a $1,000 present to pass a mile of work of grade or material strike these poor underpaid young men? To-day the head engineer gets $3,000 per annum; the track manager gets $12,000. There is not a sub-engineer on the works or in the office who gets as much as the ticket agent at the corner of St. James street."

Market Report of Engineering Materials.

New York, February 4, 1886.

NOTE.—The following Market Report gives wholesale prices on the New York Market unless otherwise stated. It is intended as a general guide to the estimating engineer. We give it with this caution, that, as is well understood in business transactions, the amount of bill, distance from market centre and conditions of payment will have a material influence on the final paying prices.

IRON.

STRUCTURAL IRON.		
Angles	1.95c @	2.00c
Tee	2.25 @	2.35
Beams and channels American	3.0 @	
Tank	1.95 @	2.1
Shell	2.4 @	2.5
Steel plates, Tank	2½ @	
WROUGHT-IRON PIPE.. PITTSBURGH.		
Butt welded, black.....Discount	42½ @	45
" " galvanized..... "	32½ @	35
Lap welded black..... "	60 @	62½
" galvanized..... "	42½ @	45
Boiler tubes..... "	55	
RAILS.		
Steel (large lots at mill).....	$34.00 @	35.00
Old rails.....	21.50 @	22.50
Old rails, steel.....	22.00 @	23.00
R R. spikes.....	2.20c. @	2.25c
R R. splice-plates.....	1.70 @	1.75
R R. track bolts, square nuts.....	2.75	
Barb-wire fencing, galvanized.....		5.00
" painted.....	4.00 @	4.25
Corrugated iron.....		
Nails		
Iron, per keg.....	2.40 @	2.50
Steel do.....	2.60 @	27.5

METALS.

COPPER.		
Lake Superior.....	$11.40 @	11.60
Other Brands.....	10.30 @	10.45
LEAD.		
Com. Domestic.....	4.60	4.65
Lead Pipe.....	.06¼c.	
Tin-Lined Lead Pipe.....	.15	
Sheet Lead.....	.07¼	
ZINC.		
Sheet.....	$5.10 @	5.20

BRICK.

Cargoes (afloat)		
Haverstraw.....per M.	$8.00 @	8.25
Fishkill.....		
Up-River.....		
Jerseys.....		
Long Island.....		
" pale.....	4.00	
FRONTS.		
Croton, red.....	11.00 @	14.00
" dark.....	11.00 @	14.00
" brown.....	10.00 @	13.00
Philadelphia pressed.....	24.00 @	25.00
Trenton "	24.00 @	25.00
Baltimore "	37.00 @	41.00
Buff	33.00 @	35.00
Enameled English	65.00 @	130.00
" American	85.00 @	120.00
Fire brick	24.50 @	55.00

CEMENT.

The following price current is made up entirely from quotations furnished us directly by the firms dealing in each brand; the prices are understood to be wholesale in New York, subject to such special rates as large quantities may warrant:

Alsen's Portland Cement Works.....	$2.50 @	$3.00
BAETJER & MEYERSTEIN:		
Hanover Port.and.....	2.60 @	2.65
BELLONI & Co.:		
Hemmoor "Crown" brand.....		2.50
JAMES BRAND:		
K. B. & S.....	2.55 @	3.00
BROOKS, SHOOBRIDGE & Co.....	2.45 @	2.60
HOWARD FLEMING:		
Gibbs' English Portland, 400 lbs.....	2.65 @	2.90
" " K. B. & S. "	2.75 @	2.95
Stettiner, German.....	2.65 @	2.85
Lagerdorfer, "	2.45 @	2.75
Fieve, A 1, Belgian.....	2.35 @	2.50
Roman.....	2.75 @	3.00
Keene's Coarse.....	4.75 @	5.50
" Fine.....	7.75 @	8.50
" Superfine.....	8.50 @	10.00
FISHER, ERSKINE W.:		
Stettin (German) Portland Cement...	$2.40 @	2.75
GABRIEL & SCHALL:		
Vorwohler "Lion".....	2.65 @	3.10
HUDSON RIVER CEMENT CO. Rosendale..		1. 0
JOHNSON & WILSON:		
Saylor's American Portland.....	2.15 @	2.40
LESLEY & TRINKLE, Philadelphia, Pa.:		
"Giant" Portland.....	2.20 @	2.40
Improved "Union".....	1.25 @	1.50
Union.....	1.10 @	1.20
MARCIAL & Co.:		
J. B. White & Bros. Coarse...	4.50 @	5.00
" Fine.....	8.00 @	10.00
" Portland.....	2.45 @	2.85
NEW YORK CEMENT CO.:		
Rosendale.....		1.20
N. Y. & ROSENDALE CEMENT CO.:		
Rosendale, "Bridge" brand.....		1.10
SINCLAIR & BABSON:		
K. B. & S.....	2.35 @	2.60
STANDARD CEMENT CO.		
E. THIELE:		
Dyckerhoff.....	2.90 @	3.25
UNITED STATES CEMENT CO.:		
Windsor.....	1.00 @	1.10
Standard.....		1.15
Cable's Portland.....	2.15 @	2.40
UNION AKRON CEMENT CO.:		
Akron "Star" brand.		

ASPHALT.

Prices range per ton.....	$15.00 @	20.00
According to quantity or brand, and whether taken from vessel or store.		

LIME.

Rockland, common per bbl.....	1.00	
" finishing.....	1.20	
State, common.....	.90	
" finishing.....	1.10	
Kingston, ground.....	95 @	1.00
Add 25c. to above figures for yard rates.		

STONE.

Cargo rates at New York.

Amherst freestone, No. 1 per cub. ft.	0.95 @	1.00
" " No. 2 "	0.75 @	0.85
" " light drab "	0.80 @	0.95
Berlin " in rough "	0.75 @	1.00
Berea " " "		
Brown stone, Portland, Ct. "	1.00 @	1.35
" Belleville, N. J. "	1.00 @	1.35
Granite, rough.....	0.45 @	1.25
Common building stone per load.	2.00 @	3.00
Base stone, from 2½ to 6 ft. lengths, per lin. ft.....	0.40 @	3.00

SLATE.

Purple roofing per square.	6.00 @	7.00
Green "	6.00 @	7.00
Red "	15.00	
Black Penna. (at New York) "	4.50 @	5.00

LUMBER.

Prices for yard delivery in New York.

PINE, Common box per M.	18.00 @	20.00
" Choice "	65.00 @	70.00
Tally plank, 1¼ in.10 in. dres'd. each.	.44 @	.50
Tally boards, dressed com. "	.28 @	.30
SPRUCE, Boards dressed "	.25 @	.28
Plank, 1¼ in "	.28 @	.30
" 2 in. "	.38 @	.40
" 2 in. dressed "	.43 @	.45
Timber per M.	20.00 @	22.00
HEMLOCK, Boards each.	.18 @	.20
Joist, 2½ × 4 to 4 × 6 in..... "	.16 @	.44
OAK per M.	55.00 @	65.00
CYPRESS 1, 1¼, 2 and 2½ in "	35.00 @	40.00
YELLOW PINE, Girders "	25.00 @	30.00
Dressed flooring "	28.00 @	35.00
SHINGLES, Extra shaved pine, 16in. "		
" sawed 18 in. "	5.75 @	6.00
LATH, Cargo rate "	2.30 @	2.35

PAINT.

Lead, white, American dry per lb	.04½ @	.06
" " " in oil pure "	.06½	
" English, B. B. in oil "	.08½ @	.08¾
" Red, American "	.05¼ @	.05½
Litharge "	.05 @	05½
Venetian red, American "	.01 @	.01¼
Indian red "	.05 @	.10
Vermillion, American lead "	.10½ @	.12½
Paris green "	.15 @	.20
Umber, Amer. raw and powdered per lb.	.01¼ @	.01¾
Drop black, Amer.....	.07 @	.13
" " Eng.....	.11 @	.13
Chrome green.....	.05 @	20
Oxide zinc, American.....	.03¼ @	.04
" French.....	.06 @	.08

Trade Notes.

E. & G. Brooks will build steel works at Birdsboro, Pa., in the spring.

THE Real Estate Exchange is about to apply for a new charter, and a bill has been drawn up for presentation to the Legislature.

THE New York, Pennsylvania and Ohio R. R. shops at Meadville, Pa., are building three Mogul freight engines, with 18 by 2 inch cylinders.

A NATIONAL Steel Wire Association has been formed and prices advanced five per cent. Charles O. Jones of Brooklyn, N. Y., is secretary of the organization.

THE frame-work for a new steel-clad steamship is going up at the yards of the Globe Ship-building Company, Cleveland, O.

THE Muskegon, Mich., Car and Engine Works have been sold to the Chicago & West Michigan Railway Company for $38,000. They were valued at over $100,000.

THE Pennsylvania pipe manufacturers are busy and expect to make material for 500 to 600 miles of natural gas pipe lines this year.

THE Steelton Pa., car works, which have been lying idle for some time, have received an order from the Bethlehem Iron Company for 100 ore cars, to be used by that company at its mines in Cuba.

THE Millerton Iron Company has nearly completed its new furnace at Irondale, which will take he place of the furnace destroyed by fire some eight months ago. The new furnace is 55 feet high and 9 feet 6 inch bosh and will use charcoal as fuel.

SHOENBERGER & Co's new Bessemer plant, being erected at their works in Pittsburg, will be one of the largest of the kind in the country. The firm will commence the manufacture of steel rails exclusively.

A MACHINE has been invented in London, Eng., for resurfacing wooden pavements. It cuts off half an inch to three inches of the upper surface of the pavements, and advances at the rate of a foot a minute in spite of gravel or dirt.

The Pond Engineering Company, of St. Louis, Mo., report a fair amount of business in their Jarvis patent furnace for setting steam boilers. Among contracts recently carried out are six boilers for the Jenney Electric Light Company, Peoria, Ill.; two for the Greeley [Col.] Electric Light Company; two for the Capital City Gas Light Company, Des Moines, Ia.; two for the Bass Iron Works, Fort Wayne, Ind.; two for the Davenport [Ia.] Gas Light Company; one for the Jenney Electric Light Company, Fort Wayne, Ind., and one for Jas. E. Boone & Co., Sioux City, Ia.

COLONEL A. B. LINDERMAN, of the Savannah, Dublin and Western Short Line R. R., has gone to England. He is in the market for 22,000 tons of steel rails, and from recent London correspondence, he thinks he can save money by buying his rails in England. In any event the object of his visit is to look into the market across the water before making contracts.

THE Troy Steel & Iron Company (the Albany & Rensselaer Iron Company reorganized, with a capital of $2,500,000) is running all departments full, except steel. This department will start in about March 1, the works employing altogether 400 to 500 men. They are building a new blast furnace on Breaker Island, below Troy, N. Y.

THE partnership between Messrs. Lassig and Alden, owning bridge and iron works in Rochester, N. Y., and Chicago, Ill., has been dissolved by mutual agreement. Mr. Alden retains the Rochester works under the name of the Rochester Bridge and Iron Works, and Mr. Lassig retains the Chicago works.

AT an important meeting of the Eastern Iron Conference, held at Philadelphia, it was unanimously decided to recommend an increase of one-tenth of a cent per pound, in the price of all grades of iron in order to cover the increased cost of production. A resolution was adopted calling upon Congress to refrain from attempting a general revision of the tariff at this time, believing that revision of duties for the purpose of reduction will check the growth of confidence, and cause a serious shrinkage in business.

THE keel for a new steamer will be laid at Mr. Roach's yard at Chester, Pa. The vessel will be 324 feet long over all, 42 feet beam and 24½ feet deep. She will be fitted for nearly 100 cabin passengers, and will be known as the Alliance. She is the first of three new steamers for the United States and Brazil Mail Company, between New York and Buenos Ayres.

LLOYDS' refuse to rate vessels built of basic steel made from cheap pig iron is a great blow to Thomas Gilchrist steel producing firms. Lack of uniformity in the plates and other defects due to an excessive percentage of phosphorus are the reasons alleged. The Bessemer and other acid processes are also slightly affected by Lloyds' action.

THE Roanoke, Va., Machine Works have closed a contract with the New York, New Haven and Hartford Railroad for the construction at once of 500 freight cars. The Norfolk and Western Railroad has given an order for two new engines, to be followed by an order for seventeen more. The works are also expecting an order in the early spring for 500 more freight cars.

PHILADELPHIA, Jan. 31.—The steel rail makers of this State have recently gained a piece of information that has given them no small amount of annoyance. This is that just prior to his death, William H. Vanderbilt ordered 30,000 tons of steel rails in England. As the duty on them is $17 a ton, they must have been obtained below $20 per ton. The knowledge of this order having been given has caused several companies to defer giving their orders, and as they are good customers the motives which incited Mr. Vanderbilt to give the order are to be inquired into.

THE arrivals of foreign cement this month have not been very extensive, and a considerable portion found immediate delivery on contract. Indeed, we do not know of any standard brands available in first hands, and two or three of the agents, with quite a little amount afloat, report pretty much everything sold, with negotiations pending that are likely to send out orders for further shipments. The tone of the market is also stronger, as, since our count of stock on the 1st, there is less apprehension of a weighty unsold accumulation, and the cost of freight room, according to latest advices, is increasing. Domestic grades are firm and meet with a demand quite up to a proportion of that shown on other descriptions of material.—Record and Guide.

WORK on the 80 feet lattice girders and wrought-iron cylinder pier for the Chicago and St. Louis Railroad is progressing at the works of the Chicago Forge and Bolt Co. This company has just completed and shipped 20 Howe truss spans and the ironwork for two turn-tables for W. J. Coolidge, Chicago. The works are running day and night on large orders for car-axles. The foundations for the new rolling mill and steam hammers are being laid, plans for a new forge building, 125 x 420 feet in size, and a new rolling mill and bolt works, 50 x 400 feet in size, are made, and if the weather permits they will be erected this winter, so as to be ready for occupation by spring. Other work in hand includes two engine turn-tables for the Chicago and Alton Railroad, and a large amount of truss and roof work for buildings in the city.

THE Penn Bridge Works, at New Brighton, Pa., closed down indefinitely on the 30th ult. About 100 men are thrown out of employment.

The New Croton Aqueduct.—At shaft 17, of the new Croton Aqueduct, for the week ending January 23d, the contractors drove through hard rock, 110 feet of tunnel with two Rattler drills in each heading and two Dynamic drills on each bench.

THE *Journal of Fabrics* states that the capacity of the Passaic Rolling Mill, Paterson, N. J., is about to be increased one-half, and an engine of 2,000 horse-power will be put in, the foundations for which are now being laid. A great deal of the material for the New York elevated railways was prepared at this establishment, which will hereafter roll heavy steel plates and girders, as well as iron.

THE American Tube and Iron Co., at Middletown, Pa., are building several new furnaces and a number of threading machines for the purpose of getting out pipe more expeditiously. The mill is now turning out about 150 tons of pipe every twenty-four hours, and they expect to increase their capacity to 200 tons very shortly.